Absurdist Electronics: Design Explorations of the Physical Body in Relation to Wearable Technology

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ABSTRACT

This dissertation formalizes the term "absurdist electronics," an approach to technology design which references both avant-garde art and critical design strategies. Drawing on the Dada principle that absurdity and shock can be an appropriate response to technologically-enabled feelings of alienation, absurdist electronics seeks to jolt audiences out of a cycle of anxiety associated with technological change (Toffler, *Future Shock*) through playful, strange inventions; while simultaneously casting a critical eye on commercial design tropes which present technology as a solution to all of life's problems. Wearable and mobile technologies are especially well-suited to an absurdist response, because the body in relation to technology has historically been subject to conflicting narratives, often limited to the utopia/dystopia binary. Through a series of case studies and workshops, the absurdist electronics method has been applied to consider how absurdity may subvert principles of control and rationalism in wearable design; evading the impulse to design technology that may make the body more machine-like, and promoting technology that may make the body more transcendent and strange. In contrast to narratives of the future that are disproportionately focused on virtual bodies and bodies represented by data, the electronic inventions in this dissertation emphasize real-time physicality by deliberately intervening in physical space in ridiculous and socially relevant ways. All of the items are worn publicly, either by myself or a proxy, and the documentation has been edited into narrative videos and GIFs, taking cues from infomercials and advertisements. In addition to exhibiting the finished works, the videos have been shared online, which has allowed the work to reach an audience beyond the academic sphere. Each of the case studies is accompanied by a thorough set of instructions for technical recreation, and the tutorials are distributed online and through workshops, in an effort to contribute to Critical Making, a larger DIY movement that is expanding the scope of electronics design.

1. INTRODUCTION: ABSURDIST ELECTRONICS—A HANDBOOK, AND CRITICAL FRAMING

In the introduction to *ME++*, a book which has contributed to the theoretical grounding of this dissertation, the author, William J. Mitchell, situates himself, "I write not from the perspective of a technological futurist….but from that of a critically engaged designer whose business it is to **reflect, imagine and invent**,"[1] (emphasis mine). As a creative practitioner engaged in the creation of technological objects, I find this distinction important. The function of the investigations in this dissertation is not to be prescriptive or predictive about the role of technology in modern life, but rather to, "reflect, imagine and invent," and further, to critique and question.

Absurdist Electronics is a practice-based project situated within a rich dialogue of philosophical thought on the relationship between technology and the body, as well as within a history of artists using technology in absurd ways and to creative ends. It includes practical instructions and tips for using consumer and hobbyist electronics in creative applications, but it is important that these tips are contextualized. What I hope to reinforce though philosophical and historical contextualization through-out the text, is that technology design is not neutral, objective, universal, or value-less. Since the age of mass industrialization (at least), technology design has been dominated by the values of reason and rationalism.

When I first began writing about this project, I was attempting to frame my experiments with wearable technology as standing in opposition to commercial wearable technology. But this framework didn't seem to fit well, in part because to serve as a direct opposite or alternative, the

[1] William J. Mitchell, *Me++: The Cyborg Self and the Networked City* (Cambridge, MA: MIT Press, 2003), 6.

works would need to exist within the same framework of commercial technology, a framework which relies heavily on reason and problem-solving. As Felix Guattari has said, "The discourse of reason is the pathology…it is the discourse of reason that is in power everywhere."[2] To subvert this pathology, a different language should be used altogether, a language rooted in absurdity. Art historically, this idea was grappled with most directly by Dada artists, who were responding to the technologically-enabled destruction of WWI; and later by Surrealist artists, Fluxus artists, and late 20th Century and early 21st Century new media artists. Within design, the idea of promoting critical conversation by creating discursive and humorous objects, has been formalized in the field of critical design. The absurdist electronics method, as it will be outlined in the text that follows, will draw on both artistic and critical design strategies to produce strange electronic objects, with the goal of promoting an inclusive, critical conversation about the role of technology in relation to human and non-human bodies in the present and future tense. I have chosen to apply the absurdist electronics method to wearables specifically, because the intimate relationship between wearables and the bodies of the wearers, amplifies the relationship between technology and anxiety which I will seek to subvert through absurdity. Four original objects will be analyzed, each of which was created under the following set of restrictions: 1. They must be "wearable." 2. They must respond to some kind of external input, either data from the environment, the internet, or the wearer's own body. 3. They must resist user control and/or have the potential to become autonomous. (This is an important distinction from commercial wearable design, which privileges user control).[3]

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[2] Felix Guattari, *Soft Subversions*, ed. Sylvere Lotringer (New York: Semiotext(e), 1996), 21.

[3] Steve Mann, "Wearable Computing: Toward Humanistic Intelligence," *IEEE Intelligent Systems IEEE* 16, no. 3 (June 2001): 10. Control features heavily into Mann's principles for designing wearables in according with his HI (humanistic intelligence) theory. Particularly "constancy," a requirement that the device must always be on and available for control by the user, with a sense of immediacy that is parallel to moving a part of one's body.

Each case study will be presented as both a conceptual/discursive project situated in relation to the research questions: a). Can strange and absurd electronic augmentations to the human body address issues of anxiety and alienation related to bodies, technology and public space? b). Can working with absurdist electronics in physical space emphasize the importance of considering affective[4] qualities of the body in relation to philosophical and popular conversations of the technological future, which seek to obfuscate the body through rationalism? c). Can creating wearables for non-humans, such as plants, animals and objects, allow for a consideration of the future of the relationship between technology and bodies, through a lens that is less anthropocentric?

The conceptual analysis of the pieces will in some case include a review of other contemporary art practices which I propose may be categorized in the absurdist electronics vein, as well as a background of the relevant theoretical context for each piece. Each of the objects has been systematically performed and documented, and images of the work have been released online through social media, my personal websites urbanarmor.org, kthartic.com, and plantbots.org, and in some cases, through larger media outlets. Analysis of how these works have engaged (or failed to engage) a broader public in conversation will occur in relation to both the online and in-person

[4] "Affect can be understood then as a gradient of bodily capacity— a supple incrementalism of ever-modulating force-relations— that rises and falls not only along various rhythms and modalities of encounter but also through the troughs and sieves of sensation and sensibility, an incrementalism that coincides with belonging to comportments of matter of virtually any and every sort." Melissa Gregg and Gregory J. Seigworth, "An Inventory of Shimmers," in *The Affect Theory Reader*, ed. Melissa Gregg, and Gregory J. Seigworth (Durham, NC: Duke University Press, 2009), 2. Referring to a "paradigm shift," in the humanities beginning in the 1980s, "Since this 'turn to corporeality', there have been many revisions across the humanities of what the important elements of this orientation might be; this includes the foregrounding of difference, discipline, performativity, embodiment, movement, desire, kinaesthesia, the senses, and, increasingly within contemporary formulations, the posthuman, process, multiplicity, enactment, affect, life and immateriality. Lisa Blackman, *Immaterial Bodies: Affect, Embodiment, Mediation* (London: SAGE Publications, 2012), ix.

feedback that I have received over the course of sharing this work. Some of the pieces have also been shared in artistic contexts, such as in galleries, and at The Museum of Arts and Design in New York City, where I completed a public-facing residency program in 2017. In addition to this conceptual and observational analysis, each case study will also be accompanied by a set of instructions for technical replication.

The first case study, "Cinnabrooch," examines the relationship between absurdist electronics, efficiency and desire. The second and third case studies, "The Social Escape Dress," and "The Power Suit," use absurdity to disrupt technologically-enabled feelings of anxiety. The fourth case study, "Sunbot and Sunbot Swarm," considers how anxiety about the disappearing body, may relate to wearables for non-humans, in this case, plants. The fifth and last case study, "Workshops," follows a slightly different format, analyzing a series of creative electronics workshops which I have led over the course of my PhD research, and the quantitative and qualitative data I have obtained through these experiences.

While the case studies in this text primarily focus on wearable technology, it is my belief that the absurdist electronics method can be applied to other areas of consumer hardware and technology design as well, and may be particularly useful in considering ways to interrogate the future of the internet of things (IoT), the smart home, and domestic robotics. Further, by sharing tutorials and engaging with the field of critical making, absurdist electronics may be useful for considering the implications of consumer electronics production processes, particularly their environmental impact, an area which needs more consideration in the DIY community.

2. THE ABSURDIST ELECTRONICS RESEARCH METHOD

2.1 Absurdist Electronics: Overview

Absurdist electronics is a hybrid art/design research method which will be formalized for the first time in the text that follows. Absurdist electronics draws on the 20th Century conceptual art movement Dada as a precedent for artists, theorists, designers, and others who aim to challenge prevailing ideologies within commercial technology design, through actively incorporating emerging technologies into creative practices. Dada and successive art movements such as Surrealism and Fluxus, are apt references for the absurdist electronics method, because artists and theorists in these movements utilized absurdity as a tactic for questioning the dominance of logic and reason as organizational principles for the design of both technological and societal structures. While the influence of Dada on New Media art has been acknowledged in a general sense in art historical accounts,[5] the absurdist electronics method is unique in outlining a strategy for applying absurdist principles to designing and sharing disruptive electronic objects specifically. Because of the proximity of artistic electronic objects to consumer electronics and industrial design, absurdist electronics also draws on non-commercial design research strategies such as critical design, as defined by Dunne and Raby[6] and Matt Malpass.[7]

The absurdist electronics method consists of physically prototyping absurd, humorous, strange, or challenging electronic inventions, as a tactic for both expanding the thinking of the

[5] "Many Dadaist strategies reappear in New Media art, including photomontage, collage, the readymade, political action and performance–as well as Dada artists' provocative use of irony and absurdity to jar complacent audiences." Mark Tribe and Reena Jana, *New Media Art* (London: Tasching Books, 2006), 8.

[6] Dunne, Anthony and Fiona Raby, *Design Noir: The Secret Life of Electronic Objects* (Basel, Switzerland: Birkhäuser, 2001). Stuart Candy, "The Futures of Everyday Life: Politics and The Design of Experiential Scenarios" (PhD Diss., University of Hawai'i, 2010), 174.

[7] Matt Malpass, *Critical Design in Context: History, Theory, and Practices* (London: Bloomsbury Academic, 2017).

artist/designer who employs the method, as well as for engaging a broader public in a philosophical debate about the future relationship between humans and technology in the built and natural environment. Drawing on the Dada principle that absurdity and shock can be an appropriate response to technologically-enabled feelings of alienation, absurdist electronics seeks to jolt audiences out of a cycle of anxiety associated with technological change through playful, strange inventions; while simultaneously casting a critical eye on commercial design tropes which present technology as a solution to all of life's problems.

In contrast to narratives of the future that are disproportionately focused on virtual bodies and bodies represented by data, absurdist electronics emphasizes real-time physicality by deliberately intervening in physical space in ridiculous and socially relevant ways. An important feature of the method, is that the designs must be produced in physical space, (a rendering or digital intervention does not suffice), and they must be shared and distributed beyond an art/design exhibition context. Some tactics for distribution include sharing video and photo documentation online, distributing prints, and performing with objects publicly. Additional public engagement can be prompted through an instructional component to the method. Each of the original works discussed in this dissertation also has a companion web presence, that includes detailed instructions for re-creating the works technically. In addition, I have conducted numerous workshops on creative electronics design, which I will analyze in greater detail in Chapter 8. The knowledge-sharing aspect of the absurdist electronics method is indebted to Fluxus, an art movement descended from Dada which according to art historian Dorotheé Brill, "conceived of art as something ideally made, distributed, and owned by everybody,"[8] and is also in dialogue with

[8] Dorotheé Brill, *Shock and the Senseless in Dada and Fluxus* (Hanover, NH: Dartmouth College Press, 2010), 123.

the contemporary Critical Making movement, as defined by Matt Ratto.[9] The tutorials I have provided in this dissertation, and the pedagogical knowledge I have gained from conducting creative electronics workshops with students from a broad range of disciplinary backgrounds, are useful for broadening the scope of the audience which this work can reach, as well as for ensuring that absurdist electronics can become a replicable research method. Subsequent practitioners who wish to employ the method, are encouraged to similarly make their technical findings accessible to a broad audience.

2.2 Absurdity as Tactic: The Dada Precedent

Dada is a conceptual art movement which emerged in Zurich in 1914 and spread to Paris, Berlin, New York, and Japan. Dada was distinguished by its use of absurdity as a method for combatting a Bourgeois obsession with industrial innovation and reason, which Dada artists felt had contributed to the technologically-aided destruction of World War I. As R. Bruce Elder has explained, "Indeed we can understand DADA and Surrealism as celebrations of what human beings might become when instrumental reason no longer is the dominant agent in identity formation."[10] While Dada will serve as the primary precedent for the absurdist electronics method, I will in some places also refer to descendant movements of Dada, especially Surrealism. Dada and Surrealism are often written about together because Dada directly led to the emergence of Surrealism. Important figures such as Marcel Duchamp, Man Ray and André Breton participated

[9] Matt Ratto, "Critical Making: Conceptual and Material Studies in Technology and Social Life," *The Information Society* 27, no. 4 (2011): 252-260.

[10] R. Bruce Elder, *Dada, Surrealism, and The Cinematic Effect* (Ontario, Canada: Wilfrid Laurier University Press, 2013), 4.

in both movements and many key themes within Dada persisted in Surrealism, particularly the opposition of rationalism, which is one of the primary themes of this dissertation. As David Hopkins has argued, "both movements (Dada and Surrealism) are seen as equally committed to the irrational in human nature."[11] Hopkins also notes that in the United States, it is common to review the two movements together, a practice that may have originated in a 1936 exhibition at The Museum of Modern Art in New York titled, "Fantastic Art, Dada, Surrealism, (curated by Alfred Barr)."[12]

Another reason why Dada and Surrealism are often discussed together, is that although there are generally-accepted and identifiable differences between the core ideologies of the two approaches, the massive amount of writing and artwork produced by geographically distinct individuals associated with both movements, makes it possible to counter-argue and complicate many distinctions. For example, one of the reasons why I am drawn toward Dada, is due to my understanding of the movement as being more explicitly politically engaged and oppositional than Surrealism. Whereas Surrealist thought became preoccupied with psychoanalysis and explorations of the unconscious, an interest that could be considered more of a retreat from confrontation, the Dadaist interest in absurdity and negation is often described as being explicitly intended to combat authority, nationalism, war, and the cult of modernism. As Matthew Biro explains, "Behind Dada's political activism was the perception that the German revolution had stalled…The Berlin Dadaists were eager to correct this situation, and they desired to use art to accomplish this decidedly political

[11] David Hopkins, "Introduction," in *A Companion to Dada and Surrealism*, ed. David Hopkins (Hoboken, NJ: Wiley Blackwell, 2016), 34.

[12] Hopkins, "Introduction," 33.

end."[13] However, Biro writes about Berlin Dada activities specifically, which raises another important point in regard to analyzing both movements. Although Dada was an international movement and is often discussed cohesively, Dada activities in Zurich, Berlin, Paris, New York, and Japan are also often written about separately, because they emerged on different timelines, and the artists were working in different contexts. (And in the case of New York Dada, much of the artwork was only labelled as Dada retroactively).[14] The breadth of activity within both Dada and Surrealism, executed by geographically disparate figures who often fell-out and disagreed, and yet who undoubtedly influenced one another, complicates, though does not invalidate, efforts to discuss one practice at the exclusion of another. Further, where I have considered Dada to be more explicitly political and confrontational than Surrealism, especially in the context of the famous Surrealist Salvador Dalí's turn toward commercialism[15], this does not mean the Surrealists were apolitical. In fact, Abigail Susik argues that many Dadaists (particularly those in New York) abstained from or were judged ill-fit to fight in World War I, and so were more emotionally removed from the war than figures such as André Breton, who was engaged in active combat, and who broke away from Dada to become Surrealism's primary founder.[16] Susik implies that Surrealism is the movement more associated with a response to political trauma, but descriptions of Dada which would repute this stance are plentiful, for example Laura Hoptman's statement,

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[13] Matthew Biro, *The Dada Cyborg: Visions of the New Human in Weimar Berlin* (Minneapolis: University of Minnesota Press, 2009), 27.
[14] Amelia Jones, *Irrational Modernism: A Neurasthenic History of New York Dada* (Cambridge, MA: The MIT Press, 2004), 11.
[15] Elliot H. King, "Surrealism and Counterculture," in Hopkins, *A Companion to Dada and Surrealism*, 647. King writes of Dalí's commercial collaborations with *Vogue,* Walt Disney and Alfred Hitchcock, among others.

[16] Abigail Susik, "Chance and Automatism: Genealogies of the Dissociative in Dada and Surrealism," in Hopkins, *A Companion to Dada and Surrealism*, 397.

"Dada emerges from the unbearable moral pressure on art to justify itself in the face of vast human indignity. The psychic wound is its source material, its inspiration, and its fuel."[17]

While Dada and Surrealism are both often considered in relation to the trauma of war, the Dada response is distinguished by its commitment to the disruptive power of absurdity.[18] Dada artists were working in the aftermath of World War I, a war which yielded unprecedented casualties in Europe,[19] with some nations losing over 3% of their total population through military deaths alone.[20] These exceptionally high death tolls were largely caused by the incorporation of industrial technologies into warfare, such as automatic weapons,[21] chemical weapons[22] and radio surveillance.[23] Many Dada artists witnessed the disastrous effects of technology applied to warfare in World War I, and noted how these events yet did nothing to disturb the prevailing Bourgeois faith in logic and technology as representative of progress, and therefore goodness. According to

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[17] Laura Hoptman, "A History of Dada Today in Three Parts," in *Black Dada Reader*, ed. Adam Pendleton (London: Koenig Books, 2017), 12.

[18] Absurdity is also present in Surrealism, and I will sometimes reference relevant Surrealist artworks for this reason, but the Surrealist movement is more defined by its interest in human consciousness. For example, Lewis Hyde quotes Marcel Duchamp (who was involved with both movements) as describing Dada in the context of opposition/negation, something Surrealism wished to move beyond, "While Dada was a movement of negation…Picabia and I wanted to open up a corridor of humor that once led into dream-imagery and, consequently, into Surrealism." The quote refers to Francis Picabia, a peer of Duchamp who also worked within both Dada and Surrealism. Lewis Hyde, *Trickster Makes This World: Mischief, Myth and Art* (New York: Farrar, Straus, and Giroux, 2010), 274.

[19] Brill, *Shock and the Senseless,* 62.

[20] Broadberry and Harrison calculate over 9 million military deaths (not including civilian) across 16 nations, and note that Germany lost 3% of its entire population and France lost 3.4%. Stephen Broadberry and Mark Harrison, *The Economics of World War I,* (Cambridge, UK: Cambridge University Press, 2005), 27.

[21] "Most murderously efficient of all World War I weaponry was the machine gun… a tool for industrial-strength killing." David M. Kennedy, "Introduction," in *World War I,* by S.L.A. Marshall (New York: Houghton Mifflin, 2001), viii.

[22] Edgar Jones, "Terror Weapons: The British Experience of Gas and Its Treatment in the First World War," *War in History* 21, no. 3 (2014): 355. In a review of the terror and trauma inflicted by gas attacks, Jones quotes accounts of, "uncontrolled anxiety during a gas attack," that, "could cause men to tear off their protective masks, or act 'as though they had temporarily lost their reason.'" (356). This framing adds poignancy to the earlier analyses I have cited of the Dada rejection of reason functioning as a response to trauma.

[23] Elizabeth Bruton and Graeme Gooday, "Listening in Combat – Surveillance Technologies Beyond the Visual in the First World War," *History & Technology* 32, no. 3 (2016): 213, https://doi.org/10.1080/07341512.2016.1231782.

Jennifer Higgie, Dada artists used absurdity in their work as, "an aptly alienated response to a culture that could sanctify such horror."[24] For example, Marcel Duchamp was photographed by Man Ray in 1920, dressed as a female alter ego named Rrose Sélavy, a move which was considered shocking at the time. Sélavy's "birth," according to Hopkins, "metaphorized the 'death' of Duchamp, which in turn was linked to the death of a generation of young men in World War I via the photograph of *Dust Breeding* produced around this time by Man Ray."[25]

2.2.1 The Function of Negation

In some analyses of Dada practice, the absurdist approach is seen as aggressive, with shock being a tactic designed to gain the attention of a broader public. As Walter Benjamin described in his seminal essay, "From an alluring visual composition or an enchanting fabric of sound, the Dadaists turned the artwork into a missile. It jolted the viewer, taking on a tactile [taktisch] quality."[26] Dorotheé Brill associates the use of absurdity in Dada with senselessness, and explains how "senseless artistic production can thus function as a source of shock,"[27] a quality which Dada artists used to provoke audiences out of a disinterested state of viewing. This aim also points to the importance of considering the role of the audience in analyses of Dada. Dada is often noted for

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[24] Jennifer Higgie, "Introduction," in *The Artist's Joke,* ed. Jennifer Higgie (London and Cambridge, MA: Whitechapel Gallery and MIT Press, 2007), 13.
[25]David Hopkins, "New York Dada: From End to Beginning," in *A Companion to Dada and Surrealism*, ed. David Hopkins (Hoboken, NJ: Wiley Blackwell, 2016), 108.

[26] Walter Benjamin, "The Work of Art in the Age of its Technological Reproducibility: Second Version," in *The Work of Art in the Age of its Technological Reproducibility and Other Writings on Media,* eds. Michael W. Jennings, Brigid Doherty, Thomas Y. Levin, trans. Edmund Jephcott et al. (Cambridge, MA: The Belknap Press of Harvard University Press, Cambridge, 2008), 39.
[27] Brill, *Shock and the Senseless,* 13.

positioning itself against the art world and its association with bourgeois power,[28] but Dadaists still wanted their work to gain notice—particularly from a broader public—and they actively manipulated the media as part of their attention-gaining tactics. For example, when Dadaist Tristan Tzara distributed press releases claiming that the popular movie star Charlie Chaplin had joined the Dada movement, and falsely claimed that he would appear at a Dada event.[29]

Biro notes that Dada artists were also actively thinking through the nature of humanity's relationship to technology through their work, which was in many ways a productive process that utilized new media technologies in its creation. Pointing specifically to Hannah Höch's work with collage, Biro writes, "The Dada cyborg helped the Dadaists and their audiences reflect on the changes in how they thought, acted, perceived, and existed as a result of technology's impact on their bodies and minds..."[30] While Dada artists sought to disrupt viewers, and force them to pay attention to the problems they saw mounting around them, they were also trying to make sense of these changes themselves, and there is a degree to which their use of absurdity represented a reprieve from this anxiety-ridden puzzle. Biro's analysis of Dada artwork as being productively engaged in "radical identity politics,"[31] points to the fact that pinpointing an exact intent behind Dada's interest in absurdity and negation is open for negotiation. Indeed, in recent years, Dada has been examined and re-examined through lenses such as feminism, queer theory, post-humanism, and spiritualism.[32] Elizabeth Benjamin, in her philosophical analysis of the links between Dada

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[28] Rasula details quotes from posters in the International Dada Fair in Berlin in 1920, "Down with art," and "Dada is the deliberate subversion of bourgeois ideology." Jed Rasula, *Destruction Was My Beatrice: Dada and the Unmaking of the Twentieth Century* (New York: Basic Books, 2016), 81.
[29] Susik, "Chance and Automatism," 319.
[30] Biro, *The Dada Cyborg*, 14.
[31] Ibid, 10.
[32] Spiritualism: Leigh Wilson, "Miraculous Constellations in Real Material:' Spiritualist Phenomena, Dada Photomontage, and Magic," in *The Machine and the Ghost: Technology and Spiritualism in Nineteenth-to-Twenty-First Century Art and Culture,* ed. Says Mays and Neil Matheson (Manchester, UK: Manchester University Press, 2013). Post-humanism: Andrei Codrescu, *The Posthuman Dada Guide: Tzara and Lenin Play Chess* (Princeton, NJ: Princeton University Press, 2009). Feminism: Amelia Jones, *Irrational Modernism: A Neurasthenic History of New*

and Existentialism, also addresses the question of whether Dadaists were hoping for productive change through their use of negation, or if they were just, "rebelling for rebellion's sake?" Benjamin goes on to assert, "I posit that Dada and Existentialism both represent a fundamentally positive affirmation of humanity through the perpetual quest for authenticity, and that this authenticity is most efficiently achieved through ambiguity."[33] Benjamin's analysis implies that the negation inherent to Dada is an acknowledgement of the complexity of the human condition. This perspective is echoed by Jed Rasula, who writes, "For the Rumanian artists who congregated at the cabaret, it was a word they said to each other all the time in conversation: *da, da,* meaning, "yes, yes."[34] These analyses of Dada absurdity as being potentially productive, are key to the absurdist electronics method, which also seeks to use absurdity to engage in productive dialogue regarding the relationship between human bodies and technology.

This more productive understanding of Dada absurdity can be seen echoed in the art movement Fluxus, which emerged in New York in the 1960's and later spread to France and Japan, among others.[35] Fluxus artists sought to critique institutionalized art and rationalism, and were heavily influenced by Dada absurdist tactics. In a 1965 manifesto, Fluxus theorist George Maciunas contrasted Fluxus art with institutional high art, classifying Fluxus work as "art amusement," and describing it as "the fusion of Spikes Jones Vaudeville, gag, children's games

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York Dada (Cambridge, MA: The MIT Press, 2004). Queer Theory: Louise Downie, *Don't Kiss Me: The Art of Claude Cahun and Marcel Moore* (London: Tate Publishing, 2006).

[33] *Elizabeth Benjamin, Dada and Existentialism: The Authenticity of Ambiguity* (London: Palgrave Macmillan, 2016), 12.

[34] Rasula, *Destruction Was My Beatrice,* 9.

[35] Natasha Lushetich, *Fluxus: The Practice of Non-Duality* (Amsterdam: Rodopi, 2014), 1–2.

and Duchamp."[36] In addition to valuing play and amusement within art, the Fluxus movement valued accessibility, which often meant presenting performances and happenings in public space. For example, a performance by Robin Page, *Block Guitar* (1962) required performers to exit the theater and travel around the block, with the audience in pursuit. In addition to presenting their work outside of art-specific contexts, Fluxus artists produced work in the form of scores, or instruction sets, which allowed their work to be easily distributed and replicated. The Fluxus use of instructions both potentially democratized their work, and introduced principles of chance into artistic creation, negating the idea of the individual author/artist as sole creator. I will look at Fluxus practice in greater depth in Chapter 8: Workshops, where I will further detail the knowledge-sharing aspect of the absurdist electronics method.

2.2.3 Contemporary Uses of Dada

Although Dada was a relatively short-lived movement, lasting only from 1916–1923,[37] it has been credited with influencing numerous developments in art and pop culture, both for its radical positionality, and for its adoption of new media into artistic production, such as photography, collage, video, and industrially-produced consumer products (incorporated into readymades). Regarding Dada's lasting cultural influence, Rasula writes,

> After the prolonged conflagration of another World War and the topping of the Third Reich, Dada's distant provocations began to be heard again, delayed like a sonic boom. Nascent groups around the world acknowledged a debt to Dada, from Gutai in Japan to Fluxus in New York…Without Dada we would have no mash-ups, no samplings, no

[36] George Maciunas, "Manifesto on Art/ Fluxus Art Amusement," (1965), accessed December 10, 2018, http://fluxusfoundation.com/about/cv/fluxmanifesto-manifesto-ii/fluxmanifesto-on-fluxamusement-1965/.

[37] Hopkins, "Introduction," 23.

> photomontages, no happenings—not even Surrealism, or Pop art, or punk…Without Dada, modern life as we know it would look very, very different…[38]

However with the exception of Fluxus, which was active in its reference to Dada, most connections to Dada in contemporary creative practice are traced through analysis and art historical accounts, rather than by creative practitioners. An important exception within media art in particular, is the "Cyber Dada Manifesto," by Dale Nason and Troy Innocent,[39] a manifesto which uses Dadaist language, in the sense of offering many short directives and exclamatory statements. It also maintains a Dadaist form, with frequent line breaks and changes in case. A digital version opens with the declaration, "DIGITIZE THE WORLD. (A new life awaits you). TECHNOLOGY is speeding ahead: DIGITIZE THE WORLD. (A new life awaits you). TECHNOLOGY is speeding ahead." And goes on to urge readers to "wear technology," hack technology, "LEARN TECHNOLOGY," and to move away from more traditional materials of art making. The V&A Museum has another version of the manifesto in its collection, this one comprised of numerous blocks of text cut-out and photocopied, visually resembling Dadaist collage and automatic writing.[40] The Cyber Dada Manifesto is true to its Dada influences in both form and content, and it can be interpreted multiple ways. On the one hand, the opening declarative, "DIGITIZE THE WORLD. (A new life awaits you). TECHNOLOGY is speeding ahead," reads as a critical parody of a techno-utopia. The promise of a new life is paired with a reminder of the speed of change, which can also be read as ominous, or as a threat. Elsewhere in the manifesto, the writers' urgings feel sincerer, even encouraging:

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[38] Rasula, *Destruction Was My Beatrice*, 17.
[39] Dale Nason and Troy Innocent, "The Cyber Dada Manifesto," *Leonardo* 24, no. 4 (1991): 489.
[40] Troy Innocent and Dale Nason, *Cyber Dada Manifesto (print)*, 1990, accessed March 22, 2019, https://collections.vam.ac.uk/item/O239561/cyber-dada-manifesto-print-innocent-troy/.

> Learn electronics, computer programming: the arts of the future
> Don't be intimidated by flashing lights and buzzing, and computers
> that look like microwave ovens!
> Master technology so it won't beat you as it rapidly fills the world.

The Cyber Dada Manifesto is an important reference for how to maintain a Dada practice within contemporary media art. It is contradictory, declaratory, and difficult to define or contain. The absurdist electronic method differs from Cyber Dada, however, in that it looks to specific aspects of Dada as a reference—particularly the idea of using absurdity and negation as a means for dealing with anxiety, and for gaining a better understanding of humanity's relationship to technology—but it does not adopt all of its positions or formal styles.

An excellent example of a contemporary examination and active use of Dada theory and practice, that is also selective in its interpretation and application, can be found in Adam Pendleton's *Black Dada Reader* (2017) and manifesto. A project which began as a manifesto and series of paintings in 2008, followed by a spiral-bound compilation of photocopied texts in 2011, *The Black Dada Reader* includes both contemporary and historical texts, including writings by Hugo Ball, Adrian Piper, Stokely Carmichael, and Sun Ra. Susan Thompson describes the ideologies as such:

> Black Dada is more than a notion. Black Dada declares and inquires, signals and speculates, conjoins and contrasts. Predicated on simultaneity, apposition, and fragmentation, Black Dada operates within disjuncture and dissonance. It is expansive, inclusive, elastic, but not passive. It does not accept, it asserts. And reasserts.[41]

[41] Susan Thompson, "The Black Dada Reader: Coming into Being," in Pendleton, *Black Dada*, 10.

The introductory text to this volume directly addresses some of the contradictions that are often present in discussions of Dada. Was Dada a movement focused on negation, bordering on nihilism? Or was the negation and provocation inherent to Dada centered on more productive aims? Does it seek solutions, or does it, "introduce the uncomfortable possibility that nothing can be fixed"?[42] One of the great contributions of *Black Dada* is that it acknowledges these questions, and answers all of them with "yes."

> Black Dada is the name I borrow for the immanent historical possibility of this transformation: *Black* for the open-ended signifier projected onto resisting objects, *Dada* for *yes, yes*, the double affirmation of their refusal. Yes, yes to afro-conceptualism, yes, yes, to the practice of abstraction, yes to history, all of it, yes to freedom, yes to flight, yes to flying in the future, heart was going like mad yes, I say yes.[43]

Further, Black Dada is an argument for acknowledging the history of the artistic and political avant-garde, while building a model for thinking the future. Its future-thinking objective necessitates that Dada serve as a reference, not a recipe. From Pendleton's manifesto:

> Black Dada: we are not naïve
>
> Black Dada: we are not successive
>
> Black Dada: we are not exclusive
>
> Black Dada: we abhor simpletons and are perfectly capable of an intelligent discussion!...

[42] Hoptman, "A History of Dada Today in Three Parts," in Pendleton, *Black Dada*, 12.

[43] Adam Pendleton, "Afterward," in Pendleton, *Black Dada,* 347.

> …Black Dada is a way to talk about the future while talking about the past
>
> History is an endless variation, a machine upon which we can project ourselves and our ideas
>
> That is to say it is our present moment[44]

Black Dada draws strength from the fundamental position of Dada, which is to question entrenched systems of value, and applies this positionality to challenge values that are inherent to racism and capitalism. Like the Cyber Dada Manifesto, the format of *The Black Dada Reader*, incorporates Dadaist values into its structure at various points; references and writings are pulled from a wide-range of sources, book chapters are unabashedly photocopied and original contributions ignore margins and don't include page numbers. The typography on its cover is bold and striking, reminiscent of political posters from the 1960's. The refusal to abide by traditional book formatting precedents, yields a project that feels accessible, DIY and unexclusive. There is a feeling that Black Dada is meant to be productive, and to create a framing which can be applied by others with a degree of freedom. As Thompson writes, "Pendleton projects a world in which all manifestos are Black Dada manifestos, whether they realize it or not."[45] In this sense a parallel can be found to a seminal philosophical text which has also been subject to a wide range of interpretations and

[44] Adam Pendleton, "Black Dada Manifesto," in Pendleton, *Black Dada,* 333.
[45] Thompson, "The Black Dada Reader," in Pendleton, *Black Dada,* 10.

applications within media art, Deleuze and Guattari's *A Thousand Plateaus.* In the introduction to the 2003 edition, Brian Massumi writes:

> Most of all, the reader is invited to lift a dynamism out of the book entirely, and incarnate it in a foreign medium, whether it be painting or politics. The authors steal from other disciplines with glee, but they are more than happy to return the favor. Deleuze's own image for a concept is not a brick, but a 'tool box.'[46]

Drawing on these precedents, I seek to point toward Dada as an important reference for contemporary critical electronics practice, and as a framework for guiding *production*. I do not seek to recreate Dada exactly. Nor do I seek to create a philosophical or art historical canon, which will unequivocally prove the links between Dada and critical electronics practice. Rather, I seek to draw on Dada while constructing the absurdist electronics method.

2.3 Critical Design: Background, Intersections, Divergences

While the framing and theoretical thought provided by Dada and the many movements which count themselves among its predecessors are useful for considering the broad, cultural implications of the cult of reason, and how absurdity can create disruption; the design methodology critical design is useful for considering how these patterns play out in the design of technological objects specifically. Critical design, or, "design that asks carefully crafted questions and makes us think,"[47] is a design-research method that falls within a larger movement to expand the scope of

[46] Brian Massumi, "Translator's Forward: Pleasures of Philosophy," in *A Thousand Plateaus: Capitalism and Schizophrenia*, by Gilles Deleuze and Félix Guattari, trans. Brian Massumi (Minneapolis: University of Minnesota Press, 2003), xv.

[47] Dunne and Raby, *Design Noir*, 58.

the field of design beyond the limitations and ideological frameworks that are necessarily dictated by market values. Although absurdist electronic embraces hybridity, one important distinction between art and design which is critical to understanding the framing of critical design, is that design objects are normally intended to be reproduced beyond a one-off, and are therefore subject to concerns such as marketability, desirability, feasibility and profit margins. Within a consumer-based economy, this often means that designed objects are also disposable objects; their inevitable disposability is a necessary feature to make room for the purchase of more objects, and to maintain the cycle of consumer capitalism. If designers are limited to working within a consumption-based framework, their ability to challenge larger frameworks of value through their work may be limited. In recent years, there has been a surge in popularity of alternative design movements intended to enable design to exist beyond a commercial context, and to engage in broader, intellectual conversations with fields such as biotechnology, human-computer-interaction, art, urban planning and sustainability studies. Critical design is a subcategory within this larger trend of activity, most closely related to industrial design.

Anthony Dunne and Fiona Raby, designers and theorists who have been a driving force behind formalizing critical design as a field, argue that mainstream industrial design processes have built-in conceptual limitations,

> Like a Hollywood movie, the emphasis (of mainstream product design) is on easy pleasure and conformist values. This genre reinforces the status quo rather than challenging it. We are surrounded by products that give us an illusion of choice and encourage passivity.[48]

[48] Dunne and Raby, *Design Noir*, 45.

Dunne and Raby are looking for a model of doing design work that can extend beyond these limitations, and that can challenge or expand upon the status quo, instead of reinforcing it. In his effort to formalize and survey the range of work and thought that has been produced around critical design, primarily in the UK from the period of the 1990s until the present, Matt Malpass presents critical design as an alternative to industrial design that is nonetheless also working to serve the greater good of the field. According to Malpass, critical design rejects, "a role for industrial design that is limited to the production of objects conceived solely for fiscal gain and technological development."[49] This rejection enables designers to work with more imaginative freedom, outside concerns of viability, while also allowing designers to acknowledge the complexity of the problems they are addressing in their designs. (Complexity being a quality that runs counter to the typical consumerist narrative that all problems can be neatly solved by design and technology. Drawing attention to complexity is also a feature of Dada negation.) Critical design is not devoted to problem-solving in the sense that commercial design might be, but rather, to "problem finding,"[50]—seeking to promote a more nuanced, critical discourse in the field.

Dunne and Raby later built on the critical framework they established in their earlier work, to formalize a related design method they refer to as speculative design. In *Speculative Everything* the authors provide a practical example for when expanded design strategies such as critical design and speculative design may be useful: in designing systems for conceptualizing and mitigating the effects of climate change. Dunne and Raby argue that climate change will create problems and situations on a scale that extends beyond the typical consumer problem-solving framework, and that critical, conceptual design strategies will be vital tools in this context, for expanding the

[49] Malpass, *Critical Design in Context,* 1–2.
[50] Ibid, 4.

thinking of designers and citizens alike.[51] Though it is necessary not to assume that designs generated in a critical design or speculative design framework will become viable, because such a requirement would become a creative limitation, the implication is that creative thought generated through this work may potentially impact or lead to more viable designs within the broader field.[52] Though this boundary may seem delicate, it can be considered parallel to the difference between creativity and innovation, as outlined by Patrick Bateson and Paul Martin. Bateson and Martin point out that while creativity and innovation are often equated, a key difference is that innovation is intended to be useful, whereas creativity does not have a specific goal and can sometimes seem "pointless." They clarify, "for our purposes, creativity is simply about generating novelty and it is a precursor to innovation."[53] The link between non-commercial design strategies and creativity, has sometimes led speculative design and design fiction in particular, to be classified as brainstorming strategies.[54] An example of this application can be found in the work of Laura Forlano and Anijo Mathew, who have used speculative design as a brainstorming tool in workshops, to help participants critically consider the relationship between technology and urban life.[55] Whether critical design strategies are used as brainstorming techniques or whether they represent the primary output for a designer, in each case the framework can be considered a *productive*[56] method, leading to the generation of new ideas, images, and often prototypes.

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[51] Dunne and Raby, *Speculative Everything*, 9.
[52] This is one of the reasons Dunne and Raby are really adamant about distinguishing their work as art, they feel it is important to maintain a balance between strangeness and plausibility, to be effective.
[53] Patrick Bateson and Paul Martin, *Play, Playfulness, Creativity and Innovation* (New York: Cambridge University Press, 2013), 55.
[54] Suzanne Stein, et al., "Creative techniques handbook 2015 Digital Futures OCAD University," (Toronto, Canada: OCAD University, 2016), accessed March 1, 2019, http://openresearch.ocadu.ca/id/eprint/1042/.
[55] Laura Forlano and Anijo Mathew, "From Design Fiction to Design Friction: Speculative and Participatory Design of Values-Embedded Urban Technology," *Journal of Urban Technology* 21, no.4 (2014): 7-24.
[56] I use 'productive' to distinguish the method from one which would focus on analysis or synthesis of other scholarship.

In addition to functioning as a productive design method, Malpass argues that critical design can function as a *discursive* design method, because the provocative ideas it presents will promote conversation among viewers within the design field and beyond. Malpass writes, "the purposive function of the design work is discursive where the designer aims to generate debate about the theme engaged in the design work."[57] This objective is also stated by Dunne and Raby, who are particularly interested in applying the method to the task of expanding conceptions of human relationships to technology in the future.

Critical design draws strength from its proximity to commercial design, which allows it to actively critique and possibly influence the values which underpin mainstream design. This positionality is an apt reference for absurdist electronics, because absurdist electronics also deals with technology designs in physical space, many of which could be considered consumer-scale. Like critical design, absurdist electronics uses humor to oppose rationalism as a driving design principle. However, as I have earlier alluded, critical design has tactical reasons for distancing itself from art, a quality which distinguishes it from absurdist electronics. In *Design Noir,* Dunne and Raby argue, "Art is far too removed from the world of mass consumption and electronic consumer products to be effective in this context."[58] And in a "Critical Design FAQ" on their website, they have responded to the question, "But isn't it art?" with the reply, "We expect art to be shocking and extreme. Critical design needs to be closer to the everyday, that's where its power to disturb comes from."[59] Malpass is similarly firm, writing, "A problem with criticism grounded in art is that it feels like an attempt to fit critical design practice into a discourse in which product

[57] Malpass, *Critical Design,* 43
[58] Dunne and Raby, *Design Noir*, 58.
[59] Dunne and Raby, "Critical Design FAQ," accessed February 22, 2019, http://www.dunneandraby.co.uk/content/bydandr/13/0. And Veronica Simpson, "Speculate to Accumulate," *Blueprint*, no. 336 (2014): 134.

design aspires to be art, or at least places design on the same critical footing…for critical design practice to work as commentary or inquiry, its objects need to be viewed as industrial design."[60] A refrain from both sets of writers, is that the strength of critical design practice, comes from its "proximity to everyday use." By situating the concepts or objects within a design framework, they believe audiences will take the work more seriously as actual future possibilities, rather than discounting the work as art, and therefore purely fictional. They believe that if the viewer is considering an object in the context of design, they will be more likely to grapple with its larger implications as a product.

2.4 Absurdist Electronics and Hybridity

I have attempted to show the clear and justifiable delineation which practitioners of critical design have sought to make between their field and art, as an indication of why it is necessary to establish a new method, if one wishes to acknowledge both avant-garde art and design in creative electronics production; as two which fields which both seek to disrupt the modernist attitude that all problems can solved through a focused application of reason.[61] Dada and Surrealist artists were not only working against rationalism in an ideologically similar sense to later critical designers; they were also working in a way that can be considered formally similar, because they were incorporating the language and objects of industrial design into their artwork. Marcel Duchamp pioneered the practice of presenting "readymade," industrially produced objects in artistic settings with pieces such as *Bicycle Wheel* (1913), which featured a detached bicycle wheel fitted into the

[60] Malpass, *Critical Design,* 75-76.

[61] Cilla Robach, "Critical Design: Forgotten History or Paradigm Shift," in *Shift: Design as Usual or a New Rising?* ed. Lars Dencik (Stockholm: Arvinius, 2005), 35.

top of a wooden stool, looking a bit like a strange windmill; and most famously with *Fountain* (1917*),* a urinal that was submitted for inclusion in the Society of Independent Artists exhibit in New York, and rejected.[62] Other artists expanded upon this practice by pairing mass-produced objects with absurd and incongruous elements, such as *Cadeau* ("Gift," 1921) by Man Ray, an iron with a row of nails running down the center of its face. Like many Dada objects, Man Ray's work destroys the use-value of a common, household object and instills it with absurd, even violent implications. A later Surrealist object, *Lobster Telephone* (1936) by Salvador Dalí, is more humorous and dreamlike than sinister, featuring a lobster shell sitting on top of the earpiece of a rotary phone.

As I have earlier explained, Dada artists were working in the aftermath of World War I. The Dadaist manipulation, destruction and distortion of mass-produced objects was in part an attempt to respond to the spectacle of industrialization, and the anxieties associated with technology that seemed to devalue human life. This was not a measured appeal to the designers of mass-produced objects, it was an emotive response and a rebellion, which they hoped would reach a broad audience. This distinction in intended audience, is another reason why absurdist electronics can acknowledge the parallel ideologies of critical design, but ultimately cannot be considered within the same methodological framework. The primary intended audience for critical design is other design professionals. Like Dada, absurdist electronics seeks a broad audience, it aims to communicate widely and with inclusivity. To this end, purposeful adoption of artistic strategies such as narrative and emotive communication, can lend the method strength.

[62] Hutchinson argues that works of parody such as *Fountain* are a response to romantic ideals of artistic genius, originality and individualism. Linda Hutcheon, *A Theory of Parody: The Teachings of Twentieth Century Art Forms* (New York: Methuen, 1985), 107.

The absurdist electronic method recognizes the base-line anxiety that typifies modern life, produced by the pace of technological change, the economic precarity brought on by technologically-aided global capitalism, the ongoing environmental disaster wrought by industry, and the values of individualism and consumerism with which technology has become so entwined. It responds to these conditions with absurdity. It aims to be disruptive. In the legacy of critical design and Dada, it seeks a model of technology design and future-thinking that is not built on the logic of capitalism, rationalism, and productivity. Like Black Dada, it is a refusal, but also an affirmation. It provides instructions. It attempts to be generous. It is not meant to be represented by only my practice. There are multitudes of artists who share these goals and whose work could fit into the method. I will mention some throughout the text, but I will not be exhaustive. The primary goal of formalizing the absurdist electronics method will be to present the possibility of a critical, art/design research method rooted in absurdity and hybridity, without being overly restrictive. The case studies will seek to show how absurdist electronics can be practiced within the framework of specific philosophical questions regarding the relationship between technology and human bodies, in particular.

In application, absurdist electronics can be considered a type of design exploration, a category within Daniel Fallman's triangle of interaction design research, defined as designs which are "idealistic, societal and subversive."[63] (Fig 2.1) Other design-based research methods which can be grouped in this category include: critical design, speculative design, as practiced/formalized by Dunne and Raby;[64] interrogative design, as practiced/formalized by Krzstyof Wodiczko;[65] and

[63] Daniel Fallman, "The Interaction Design Research Triangle of Design Practice, Design Studies and Design Exploration," *Design Issues* 24, no. 3 (2008): 5.
[64] Anthony Dunne & Fiona Raby, *Speculative Everything: Design, Fiction and Social Dreaming* (Cambridge, MA: MIT Press, 2013).
[65] Krzysztof Wodiczko, "Interrogative Design," in *Critical Vehicles: Writings, Projects, Interviews* (Cambridge, MA: The MIT Press, 1999), 16-17.

design fiction, as formalized by Bruce Sterling[66] and practiced by Julian Bleeker.[67] Another category of design-based research, which can fall within the category of design exploration and which is closely related to critical design, is design activism as defined by Alastair Fuad-Luke: "Design activism is 'design thinking, imagination and practice applied knowingly or unknowingly to create a counter-narrative aimed at generating and balancing positive social, institutional, environmental and/or economic change.'"[68]

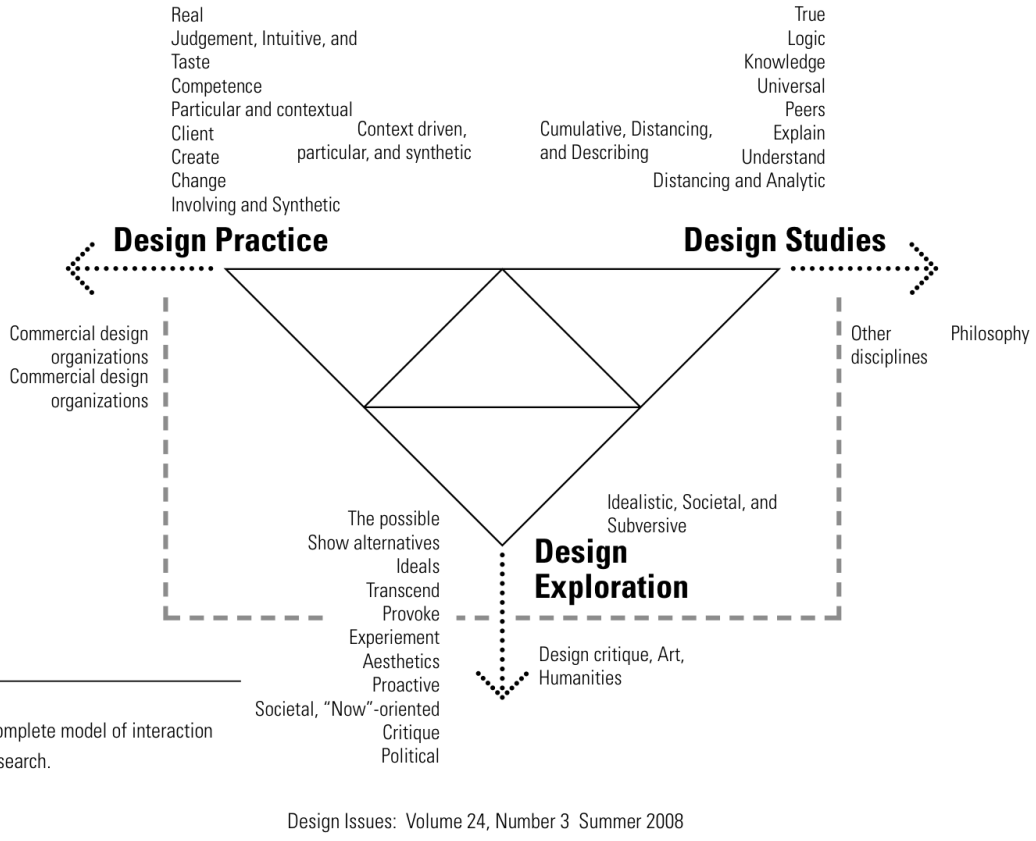

Figure 2.1: Daniel Fallman, "The Interaction design research triangle of design practice, design studies and design exploration," in *Design Issues*, 24:3 (2008), 5.

[66] Bruce Sterling, *Shaping Things* (Cambridge, MA: MIT Press), 2005.
[67] Julian Bleeker, "Design Fiction: A Short Essay on Design, Science, Fact and Fiction," March 2009, accessed February 22, 2019, http://www.nearfuturelaboratory.com.
[68] Alastair Fuad-Luke, *Design Activism: Beautiful Strangeness for a Sustainable World* (London and Sterling, VA: Earthscan, 2009), 27.

Although absurdist electronics cannot be considered a type of critical design, because definitions of critical design are adamant about limiting the field's association with art, "Design Exploration," as defined by Fallman, is a broader term and includes, "Design critique, Art, Humanities." According to Alstair Fuad-Luke, conceptual design practices such as critical design can be grouped into the design exploration category, alongside art and the humanities,[69] a categorization that confirms design exploration as an appropriate parent method for a hybrid art/design approach.

The critical framing that is inherent to the absurdist electronics method and its influences, does not exclude the possibility that practitioners of absurdist electronics may enjoy working with electronics, and remain, in some ways, optimistic about the role technology will continue to play in society, especially as a greater diversity of people become involved in its design. Applying this position in combination with Dadaist principles and critical design strategies which seek to destabilize design from within, may result in work that is strange and difficult to categorize; a confusion that can serve as a strength, in expanding the context in which the work can be considered, and reaching a broader audience.

2.5 Absurdist Electronics in Practice

Absurdist electronics uses absurdity as a counter to reason in technology design. The primary method through which these theories and principles are explored, is through prototyping electronics in physical space. Working in physical space provides opportunities for a production

[69] Alstair Fuad-Luke, *Design Activism*, 84.

of knowledge that is different from that which can emerge in digital and philosophical space, because the researcher/artist is engaging with the emotive and experiential knowledge of the physical human body. Practically speaking, prototyping electronics in physical space allows the researcher/artist to observe first-hand how their inventions look and feel on the body, and how they are perceived by others. It also allows for the observation of unpredictable interactions between the objects and both the natural and built environment, both of which exhibit qualities that are beyond human-control.

While researchers working in a theoretical space can speculate on what some of these interactions may be like, creating objects in physical space allows for the observation of qualities that the creator may not have predicted themselves, in a sense yielding a degree of control (another Dadaist principle),[70] to honestly assess how the objects exist in the world. For this observation to yield the most interesting results, it is ideal for the object to truly function—beyond an aesthetic mock-up. I recognize that this requirement presents a potential limitation to the practice. If the designer is required to physically make the object, they are limited in the degree of technology they can speculate on. However, I believe this is a worthy trade-off for the benefits which lie in creating genuinely unpredictable interactions. Furthermore, contemporary design writing bemoans the role of the designer as becoming increasingly removed from functionality, and being left only to make aesthetic decisions. Design for bodies, machines, and structures, is often seen as preoccupied with the "outer skin of the object or building,"[71] a phenomenon which relates to

[70] For example, the artist Francis Picabia made a print by taking an alarm clock apart, dredging it through ink, and dropping the pieces on paper. Susik writes, "The paradox of dada chance is here achieved through the annihilation of a functional object of orderly time, which ironically gives way to a harmonious and balanced, though essentially abstract, composition."
Susik, "Chance and Automatism," 392.
[71] Tim Armstrong, "Bodies and Machines," in *Tomorrow Now- When Design Meets Science Fiction*, ed. Alexandra Midal (Luxemborug: Mudam Luxembourg, 2007), 74.

streamline, a movement which began to aestheticize efficiency in ways that didn't always relate to the object's functionality.[72] Thomas Thwaites alludes to this phenomenon in his project, *The Toaster Project*, in which he attempts to rebuild a toaster from scratch, reproducing contemporary industrial production strategies by hand, as a method for examining the relationship between design, the environmental impact of industrial production practices, and the consumer market.[73] Most designers are not in a position to question these larger, underlying frameworks of a product's production, or even function. They can only change the color or shape of the toaster's skin.

I cannot argue that working with hobbyist electronics will solve systemic problems within electronics design, in part because the components I use—copper boards, resistors, transistors, integrated circuits—are still produced on a mass-industrial scale. However, working with electronic components does potentially abet part of the problem, in which designers are relegated to "skinning," an object, and have no input on its functionality. Learning about and experimenting with DIY electronics can allow the artist, designer, student, or hobbyist to learn more about the scope of possibilities for prototyping electronics, and will likely impact their subsequent design efforts. In a more artistic sense, working with electronics first-hand can lead to electronic objects that behave in unexpected ways, a function that may be related to their spirituality, signification, and value, outside their use-value. Another benefit of prototyping electronics in physical space, is

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[72] "It was during this period of national obsession over bodily and national efficiency that streamline industrial design began," Christina Cogdell, "Smooth Flow: Biological Efficiency and Streamline," in *Popular Eugenics: National Efficiency and American Mass Culture in the 1930s*, ed. Susan Currell and Christina Cogdell (Athens, OH: Ohio University Press, 2006), 225. Cogdell relates American obsession with efficiency to eugenics in a highly political account, which I will revisit in chapters 3 and 4. On the other hand, a less political view of streamline describes it as, "a reflection of austere economic times. Unnecessary ornament was gone, sharp angles were replaced with pure, aerodynamic forms visually communicating a smooth, frictionless, and machine-driven progress, with exotic and expensive materials replaced by concrete and glass." Richard Poulin, *Graphic Design and Architecture, A 20th Century History* (Beverly, MA: Rockport Publishers, 2012), 97.

[73] Thomas Thwaites, *The Toaster Project: Or a Heroic Attempt to Build a Simple Electric Appliance from Scratch* (New York: Princeton Architectural Press, 2011).

that it allows creative practitioners to share technical knowledge, both within their field and to a broader audience. Accessible technical information may act as a stimulus for a broader audience's interest in critically examining the technology which they are surrounded by every day.

Prototyping DIY electronics, in my experience, can be approached in two ways: the designer can first come up with an idea/or concept, and then try to make it work through an iterative process of electronics experimentation; or the designer can experiment and play with electronics in an open-ended and playful way, and allow this to lead to a more fully-formed creative concept. Ideally, the practitioner will develop a practice of working regularly with electronics, so that both sequences of production may sometimes occur. In the majority of my own pieces, I have come up with a concept which I desired to see in physical space, (such as a human whose arms have been replaced by "wacky inflatable arms" in the vein of the inflatable nylon creatures often placed in big box store parking lots (fig 2.2)), and I use my desire to see this concept realized in physical space as a motivator for solving the problem technically. Usually, the production requires many technical iterations and approaches. I will go into more detail on these processes in the case-study sections of this text, but my personal electronic prototyping process consists of a combination of working with new electronic components and modified consumer electronic objects, researching solutions in online DIY forums, and reaching conclusions from hands-on experimentation.

Figure 2.2: Kathleen McDermott, *Urban Armor #10: The Power Suit,* 2018.

As a component to this prototyping research, I have produced tutorials for recreating the works described in the case studies, and have given dozens of workshops on using electronics as a creative medium. Some of these have happened with a single group of students over the course of many weeks, while others have been one-off workshops with a finite scope. I frequently experimented across these workshop formats: sometimes providing students with technical exercises before they created their concept, and sometimes working with students to develop a concept and then systematically realize it. I obtained both quantifiable and qualitative data from these IRB-approved workshops, which I will devote more space to examining in chapter 8.

The instructional component of this project can be related to a body of freely distributed knowledge present within Open Source and Maker communities online, a phenomenon which has implications for both ideological and commercial design. Chris Anderson situates the Maker movement within "the new industrial revolution," because digital design and fabrication tools have meant that digitally-aided manufacturing can happen in homes and garages, as opposed to only in factories, claiming, "Once things can be done on regular computers, they can be done by anyone."[74] "Anyone," in this case, refers to a computer-literate person with a considerable amount of free time and a fair amount of expendable income, an identity which is in fact quite exclusive. But while criticisms have been levelled at some of the loftier claims of the Maker movement, especially regarding the fact that the movement is not at all immune to commercial stakeholders, and that it has been disproportionately dominated by men,[75] and while I do not want to overstate the accessibility of the knowledge I plan to share, I remain interested in the idea of sharing knowledge as a political act. These ideas will be discussed in greater depth in chapter 8 along with the emergent field of "Critical Making," which offers some productive ideas for reframing the Maker movement.

In addition to the philosophical implications of sharing technical instructions for recreating the absurdist electronics case studies, another reason for their inclusion is to ensure that it is at least *possible* to replicate the design explorations, even if it is not easy, so that other researchers/artists have the potential to build on these investigations. Again, these practitioners do not necessarily have to be professionals, and they are not at all required to follow the instructions

[74] Chris Anderson, *Makers: The New Industrial Revolution* (New York: Crown Business- Random House, 2012), 18.
[75] Debbie Chachra, "Why I'm not a Maker," *The Atlantic,* January 23, 2015, accessed November 20, 2017, https://www.theatlantic.com/technology/archive/2015/01/why-i-am-not-a-maker/384767/.

exactly.[76] In fact, the decision to share instructions for these pieces is a decision to align myself with the, "Professional Amateur," a term borrowed from Shumon Basar, who casts the amateur as a playful figure, writing, "The Professional Amateur… generates knowledge by elision, contingency and exacting luck."[77] Basar's amateur may be related to Lewis Hyde's definition of a trickster: a boundary-crosser, "creative idiot," and "wise fool,"[78] which Hyde directly relates to Dada and Fluxus practice.

[76] In my experience, there is usually a specific aspect of a tutorial that I wish to take and apply to a different end, rather than following an example project exactly.

[77] Shumon Basar, "The Professional Amateur," in *Did Someone Say Participate? An Atlas of Spatial Practice,* ed. Markus Miessen and Shumon Basar (Cambridge, MA: MIT Press, 2006), 34.

[78] Lewis Hyde, *Trickster Makes This World: Mischief, Myth and Art* (New York: Farrar, Straus and Giroux, 2010), 6-7.

3. THE BODY AS SITE—TRANSFORMATIVE OR TERRIFYING? DIVERGENT NARRATIVES OF WEARABLE TECHNOLOGY

3.1 Overview

Wearable and mobile technologies are especially well-suited to an absurdist response, because the body in relation to technology has historically been subject to conflicting narratives. Wearable technology can be argued equally well as a transformative force of empowerment; or as an emblem of technological inequality, and the quest for control over all things corporeal. An example of this dichotomy can be found in the variety of understandings of the word "cyborg," a term which originally emerged in reference to the need for a body-based system to allow humans to survive in outer space, but has since been widely re-interpreted and applied, with both utopic and dystopic implications. A technical definition of the term cyborg is, "a combination of the organic and cybernetic."[79] Manfred E. Clynes and Nathan S. Kline introduced the word in a 1960 issue of *Astronautics*, to refer to a body that, "deliberately incorporates exogenous components extending the self-regulatory control function of the organism in order to adapt it to new environments."[80] The practical need they were identifying, for assistive technology to allow astronauts to survive outside the Earth's atmosphere, was later filled by the spacesuit. However, the paper also had philosophic implications, because Clynes and Kline introduced the idea of a

[79] Donna Haraway, "Introduction," in *The Cyborg Handbook*, ed. Chris Hables Gray (London: Routledge, 1995), xv.
[80] Manfred E. Clynes and Nathan S. Kline, "Cyborgs and Space," in *Astronautics* (September 1960), 27.

cyborg as an invitation to man, "to take an active part in his own biological evolution;"[81] implying that cyborg design could impact the broader course of human history.

The term cyborg has since been applied to Earth-bound bodies in a variety of ways. In a 2010 interview with *The Atlantic,* Clynes reflected that the word had taken on a life of its own.[82] Cultural theorists have used the cyborg as a symbol of the human body changed by technology (or tools), regardless of whether the tool is cybernetic, or integral to survival. Andy Clark argues that humans are innately cyborgial, because they use tools to extend both their mental and physical capabilities, a feature he believes separates humans from other animals. Clark writes, "What is special about human brains…is precisely their ability to enter into deep and complex relationships with nonbiological constructs, props, and aids."[83] Clark goes on to imply that any human who has picked up a pen and externalized their brain onto a piece of paper is a cyborg, because they have extended themselves into a distributable object. Related sentiment can be found in the work of Scott Bukatman, who observes, "It has become increasingly difficult to separate the human from the technological, and this is true rhetorically and phenomenologically;"[84] as well as in the work of William J. T. Mitchell, who focuses on the ways in which human bodies have become integrated into larger digital networks, "We had become inseparable from our electronic organs; our very limbs had become fleshy antenna supports; our interconnections had ramified and intensified to an almost incomprehensible degree."[85]

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[81] Clynes and Kline, "Cyborgs and Space," 26.
[82] Alexis C. Madigral, "The Man Who First Said 'Cyborg,' Fifty Years Later," *The Atlantic*, September 30th, 2010.
[83] Andy Clark, *Natural-Born Cyborgs* (New York: Oxford University Press, 2003), 5.

[84] Scott Bukatman, *Terminal Identity: The Virtual Subject in Post-Modern Science Fiction* (Durham, NC: Duke University Press, 1993), 2.

[85] William J. Mitchell, *Me++: The Cyborg Self and the Networked City* (Cambridge, MA: MIT Press, 2003), 2.

3.2 Wearables, Accident, and the Erasure of the Body

The implication of the philosophies outlined above, is that humans have historically incorporated technologies into their bodies and understandings of self, and that continued advancements in digital and nanotechnology are likely to accelerate this pattern. Because of its proximity to the body, wearable technology seems like an obvious candidate to play a pivotal role in humankind's evolving relationship with technology and sense of self. However, it is unclear if wearable technology will be broadly adopted, and in what forms. One potential barrier to broad adoption, is the fact that wearable technology maintains a cultural connection to aggression and control, in part through its origins in military research. By his own account, Norbert Wiener's concept of feedback, which contributed to his cybernetic research and the origins of the term cyborg, was influenced by his research developing assistive targeting systems for fighter pilots in World War II.[86] As Susan Elizabeth Ryan has noted, the wristwatch, which can arguably be considered the first piece of modern wearable technology, was first developed to help British soldiers in the Boer war coordinate timed offensive efforts.[87] Paul Virilio presents shoes as a war technology, pointing to research into waterproof boots after many soldiers suffered from gangrene in World War I,[88] and to the importance of shoes in increasing soldiers' effective mobility. Other examples of wearable technology in warfare can be found in night vision goggles, camouflage, and backpacks designed to distribute heavy loads across soldiers' bodies.[89] Even more fantastic wearable interventions have been researched, and perhaps implemented, since as early as 1964.

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[86] Norbert Wiener, *Cybernetics, or Control and Communication in the Animal and The Machine* (New York: MIT Press and John Wiley & Sons, Inc., 1961), 6–7.
[87] Susan Elizabeth Ryan, *Garments of Paradise: Wearable Discourse in the Digital Age* (Cambridge, MA: MIT Press, 2014), 35.
[88] Paul Virilio, *Speed and Politics: An Essay on Dromology,* trans. Mark Polizzotti (Los Angeles, CA: Semiotext(e), 2006), 16.
[89] Ryan, *Garments of Paradise,* 35.

An image from the "NASA Technology Survey," shows a soldier in an un-powered exoskeleton built by the Cornell Aeronautical Laboratory,[90] a prosthetic that appears to be aimed at improving soldiers' stamina and physical strength. In a more recent review of research in the field, Robert Bogue finds, "Robotic exoskeletons are the topic of a major research effort, much being funded by the US military, and aim to impart superhuman strength to the wearer."[91] In "Science Fiction Becomes Military Fact," Chris Hables Gray points to brain-wave research (being conducted on monkeys as of the 1970s) that may have been aimed at controlling body movements, he concludes, "Such techniques should work on humans as well, thus insuring fast and resistance-free responses even to the most unpleasant orders."[92]

The connection between wearables and military and technological research, may cause the medium to become a site of collective anxiety, for, as Paul Virilio notes, each new technological innovation brings with it the possibility of malfunction, "adoption of a new technology is always also the invention and adoption of new accident."[93] To some degree this possibility is ingrained in public imagination through science fiction and comic books. Though he is actually an android robot made to look like a human, (rather than part human, part machine), the title character of the film series *The Terminator,*[94] is an image of technological strength and destruction encapsulated by a human-looking body, and is an embodiment of the fears surrounding humans augmented by technology. If the adoption of new technology is also the adoption of new accident, what happens when *The Terminator* turns against us? Rosie Bradoitti observes a, "fear of the imminent disaster,

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[90] Edwin G. Johnsen and William R. Corliss, "Teleoperators and Human Augmentation," in *The Cyborg Handbook*, ed. Chris Hables Gray (London: Routledge, 1995), 91.
[91] Robert Bogue, "Exoskeletons and Robotic Prosthetics, a Review of Recent Developments," *Industrial Robot: An International Journal* 36, no.5 (2009): 421-427.
[92] Chris Hables Gray, "Science Fiction Becomes Military Fact," in *The Cyborg Handbook*, ed. Chris Hables Gray (London: Routledge, 1995), 105.
[93] Virilio, *Speed and Politics,* 20.
[94] *The Terminator,* directed by James Cameron, performed by Arnold Schwarzenegger, (Orion Pictures, 1984).

the catastrophe just waiting to happen…" adding, "As a result of this state of insecurity, the socially enforced aim is not change, but conservation or survival."[95] Indeed, the current state of commercial wearable technology, as I will show in chapters 4 and 5, does not seek to change fundamental human relationships, such as our relationships with work, but rather to maintain them. Commercial wearables are also disproportionately focused on data collection, and rarely attempt to augment physical abilities, or to interact with physical space. This surface-level conservatism may assuage consumer fears of the cyborg, but as I will show, it masks aspects of the products that are still potentially insidious—the manipulation of the wearer's relationship to time and self-actualization.

This emphasis on data and digital space within commercial wearable technology design may also represent a retreat from the problems humans face in the physical world. According to Sherry Turkle, digital life is attractive to many users as a way to supplement or supplant physical relationships, because digital relationships afford the individual more control over how their interactions take place.[96] The current prevalence of wearables devoted to Virtual Reality may speak to Turkle's claims.[97] N. Katherine Hayles traces the origins of this trend of the virtual world taking precedence over the physical, to the Macy Conferences in mid-20th Century America, where the idea that a human mind could be "uploaded," and exist outside the body, was first seriously considered. These ideas were influenced by theorists such as Norbert Wiener, who was present at the conference, and who in *Cybernetics,* wrote, "It is a noteworthy fact that the human and animal

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[95] Rosie Braidotti, *The Posthuman* (Cambridge, UK: Polity Press, 2013), 9-10.
[96] Sherry Turkle, *Alone Together: Why We Expect More from Technology and Less From Each Other*, (New York: Basic Books, 2011), 160.

[97] Some examples include the Microsoft HoloLens, (mixed reality) Magic Leap (mixed reality) Oculus VR, Samsung Gear VR and Sony Playstation VR. (Gaming and training big markets).
Thad Starner, "How Wearables Worked Their Way into the Mainstream," *IEEE Pervasive Computing, Pervasive Computing, IEEE, IEEE Pervasive Computing* 13, no.4, (2017): 10 –15.
Natalie Kroc, "Reality Reboot," *HR Magazine* 62, no.8 (2017): 46–51.

nervous systems, which are known to be capable of the work of a computation system, contain elements which are ideally suited to act as relays. These elements are so-called *Neurons* or nerve cells."[98] As Hayles explains, "Wiener did not intend to dismantle the liberal humanist subject. He was less interested in seeing humans as machines than he was in fashioning human and machine alike in the image of an autonomous, self-directed individual."[99] In fact, in his 1961 introduction to the second edition of *Cybernetics,* Wiener acknowledged that robotic and cybernetic systems had, "unbound possibilities for good and evil," and accurately predicted the way in which automatic manufacturing could devalue work completed by human laborers, concluding, "The answer, of course, is to have a society based on human values other than buying or selling."[100] Despite Wiener's nuanced warnings, according to Hayles, cybernetic theory led to, "a new way of looking at human beings. Henceforth, humans were to be seen primarily as information-processing entities who are *essentially* similar to intelligent machines."[101] Hayles points to the abstraction inherent in this position, as well as to a connection between post-humanism and a homogenizing perspective that devalues bodies' differences, by assuming a universal position is even possible.[102] Using science fiction as a lens through which to study the phenomenon, she finds, "The sense that the world is rapidly becoming uninhabitable by human beings is part of the impetus toward the displacement of presence by pattern."[103] The presence Hayles refers to is physical presence, and the pattern supplanting this presence is digital code, which would tap into users' minds and take them to virtual space. Faced with a planet in crisis and technology production practices that fail to

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[98] Wiener, *Cybernetics,* 120.
[99] N. Katherine Hayles, *How We Became Posthuman* (Chicago, IL: The University of Chicago Press 1999), 7.
[100] Wiener, *Cybernetics,* 27–28.

[101] Hayles, *Posthuman,* 7.

[102] Ibid*,* 4.

[103] Ibid, 37.

address climate change, consumers may be encouraged to retreat into a digital realm. A premise that Hayles identifies as a common trope in science fiction from the mid–late 20th Century, feels somewhat prophetic in 2019. This is idea will be explored in greater detail in Chapter 7.

Hayles goes on to argue that the cyberpunk book *Neuromancer*, by William Gibson,[104] helped widely popularize the idea that brains could be uploaded to computers. In place of the cyborg dream in popular discourse, that humans would become physically invincible by melding their bodies with machines, *Neuromancer* provided a dream of power through transcendence, the melding of minds with machines, while bodies dissipated. Pointing to a consistent tendency in science fiction to prophesize the end of the human body at the hands of digital technology, Scott Bukatman asserts that, "The body must become a cyborg to retain its presence in the world, resituated in technological space and refigured in technological terms."[105] The cyborg, Bukatman implies, is the body's last hope at relevancy, in the face of a society so obsessed with the virtual, that it threatens to throw it out altogether.

3.3 Wearables, Identity, and Transformation

While the philosophies outlined above can be used to imagine a future of wearable and cyborg technology that is conservative at best, (and hellish at worst), an argument can also be made for the potential of wearable and cyborg technology to become tools for transformation and empowerment. Donna Haraway has used the term cyborg to argue for an expanded notion of

[104] William Gibson, *Neuromancer* (New York: Ace Books, 1985).

[105] Scott Bukatman, *Terminal Identity: The Virtual Subject in Post-Modern Science Fiction* (Durham, NC: Duke University Press, 1993), 247.

human identity, one that exists outside binary gender dynamics and the enshrinement of "nature," which has contributed to the, "histories of colonialism, racism, sexism, and class domination of many kinds."[106] On the topic of nature, Haraway has elsewhere written, "Nature is also a *trópos,* a trope. It is figure, construction, artifact, movement, displacement…nature for us is *made,* as both fiction and fact."[107] Haraway uses the figure of the cyborg to shed the symbolic material assigned to human bodies through a cultural obsession with nature and humanity's origin myths, "Why should our bodies end at our skin…," Haraway writes, referring to prosthetics, and challenging the very parameters of the body, many of which have been historically used to justify oppression, "We don't need organic holism to give impermeable wholeness…"[108]

Haraway's "Manifesto for Cyborgs," acknowledges the militaristic roots of cybernetic research, but nonetheless frames the cyborg as a potentially liberating identity, "Cyborg writing is about the power to survive, not on the basis of original innocence, but on the basis of seizing the tools to mark the world that marked them as other."[109] Building on Haraway's manifesto, it is possible to view the cyborg as an expression of alienation from a more traditional and nature-oriented culture. Kim Toffotti likens Marilyn Manson, "the goth rock star," to a cyborg, based on a digitally-altered promotional image in which his body is distorted, his gender is called into question, and his bellybutton is removed, confusing his own creation myth. "Like the cyborg before him, Manson reminds us that a state of nature contra the artificial is fast collapsing."[110] In so much as they relate to ideas of identity-construction, cyborgs can be related to fashion, fan-

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[106] Donna Haraway, "The Promises of Monsters: A Regenerative Politics for Inappropriate/d Others," in *The Haraway Reader* (New York: Routledge, 2004), 64.
[107] Haraway, "The Promises of Monsters," 65.
[108] Haraway, "A Manifesto for Cyborgs: Science, Technology and Socialist Feminism in the 1980s," in *The Haraway Reader*, 36.
[109] Haraway, "A Manifesto for Cyborgs," 33.
[110] Kim Toffoletti, *Cyborgs and Barbie Dolls: Feminism, Popular Culture and the Posthuman Body* (New York: I.B. Tauris & Co Ltd, 2007), 97.

fiction, comic-con, and other forms of analog and technical body adornments adopted by humans in both physical and fictional spaces, as external expressions of identities they feel internally aligned to.

However, Haraway has also examined the term cyborg in relation to non-humans, a history that has been less about empowerment and more about exploitation. She describes a study conducted by primatologist C.R. Carpenter and physiologist José Delgado in 1971,

> …on brain-implanted, telemetry-controlled gibbons at the Bermuda Primate Center, on Hall's Island. These experiments highlight the transition from an organics to a technics of control of the social body. This Atlantic island and these experiments are a tragic, ugly image for Carpenter's last field work. The man whose considerable skill and commitment had established the practices enabling scientists to watch gibbons living freely in the 1930s ended his field work surveying a brain-damaged colony in a high-tech narrative of remote control.[111]

One of the goals of Carpenter's and Delgado's research was apparently to develop a mind-monitoring system that would serve as an early-warning system for patients in mental hospitals experiencing psychotic or suicidal episodes. It was a control-oriented design of a cyborg, being tested on chimpanzees.

Similarly, the idea of the cyborg as a system for allowing a human to survive outside Earth's atmosphere, was also first tested on non-human animals, "The first primates to approach that abstract place called 'space' were monkeys and apes."[112] Haraway points to the irony of

[111] Donna Haraway, "Monkeys and Monopoly Capitalism: From C.R. Carpenter to S.A. Altmann," in *Primate Visions: Gender, Race and Nature in the World of Modern Science* (New York: Routledge, 1989), 108.
[112] Haraway, "Apes in Eden, Apes in Space: Mothering as a Scientist for National Geographic," in Haraway, *Primate Visions,* 138.

employing primates in space travel, a future-oriented field, when humankind's original interest in primatology, had been to understand the *origins* of human evolution:

> On one end of time and space, the chimpanzee in the wilderness models communication for the stressed, ecologically threatened and threatening, civilized human. On the other end, the ET chimpanzee models social and technical cybernetic communication systems, which permit 'man' to escape both the jungle and the city, in a thrust into the future made possible by the social-technical systems of the 'information age' in a global context of threatened nuclear war[113]

Writing about HAM, a chimpanzee used in test flights into space as an "understudy for man," Haraway writes, "HAM is a cyborg, the perfect child of space." She goes on to add that a cyborg is a figure that blurs the boundaries between "animals (or other organisms) and humans," *as well as* a figure that blurs boundaries between "self-controlled, self-governing machines (automatons) and organisms."[114] Haraway seems to imply that when humans incorporate technology into their bodies, it is not only the boundary between human and technology that changes, it is the boundary between humans and other organisms as well, in part because humans have relied on other organisms to develop cybernetic research. "The cyborg is the figure born of the interface of automaton and autonomy. There could be no more iconic cyborg than a telemetrically implanted chimpanzee…"[115] Although it is a fraught history, Haraway is careful not to preclude the possibility that HAM could have had some agency in his cyborg experience, describing him as "interested, intelligent, and actively participating."[116] However, the researchers working with him were clearly not trying to design a situation that privileged his control, but rather to use him as a test-subject, and to include him in a new kind of origin myth, as a predecessor to humanity in

[113] Ibid, 139.
[114] Ibid, 138.
[115] Ibid, 139.
[116] Ibid, 138.

space. Considering the complex relationship between primates and cyborg research, and building on Haraway's "Manifesto," which presents the cyborg as a figure that can challenge ideas of what is "natural," more can be done to re-examine the idea of nonhuman cyborgs, through a lens which reconsiders hierarchies of relationships between human and nonhuman entities.

While Haraway's manifesto broadened the philosophical understanding of cyborg identities, her writing is fairly abstract and does not address many logistical questions, such as how physical connections between flesh or fashion and hardware can be made. Through his experiments with both organic and inorganic bodily augmentation, the performance artist STELARC brings issues regarding a literal cyborg to the forefront. *The Third Hand* (1980), is a robotic prosthetic arm that the artist controls by contracting muscles in his legs and abdomen, and *Ear on Arm* (2007-ongoing) is a third ear, installed on the artist's arm, that consists of both skin grafts and electronic hardware. STELARC's work points to the fact that a cyborg may be grotesque, and that a literal consideration of a future populated by cyborgs raises many questions. Who will become a cyborg, and how will they afford it? Who gets to decide what a cyborg is allowed to do, where it goes, how it reproduces, and what it looks like? How do we know we can trust it? Cyborgs as depicted in Science Fiction are often ominous figures, reflecting Tim Armstrong's view of the prosthetic as, "a site both of pleasurable possibilities and of danger."[117]

On the other hand, a potential counter to disastrous associations between wearable technology and cyborgs, can be found in narratives of cyborgs that view accident in a less-negative light. The *Cyborg* comic, introduced by DC Comics in 1980, features a young man who became a

[117] Tim Armstrong, "Bodies and Machines," in *Tomorrow Now– When Design Meets Science Fiction*, ed. Alexandra Midal (Luxembourg: Mudam Luxembourg, 2007), 74.

cyborg superhero, after he "suffered a grave injury," and his father, a scientist, "saved him by replacing over half his body with cybernetic parts,"[118] (fig 3.1).

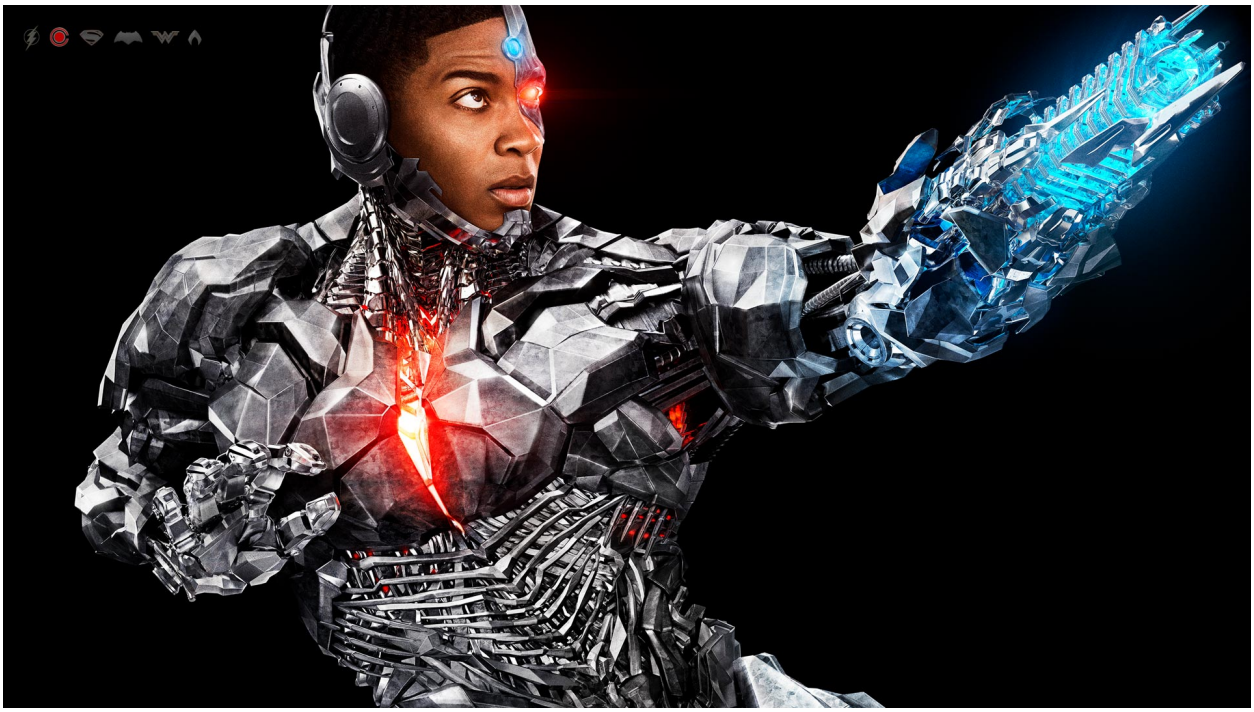

Figure 3.1: Ray Fisher as Cyborg in *Justice League.*[119]

Victor Stone, the fictional boy who becomes the superhero Cyborg, represents a common trope in wearable and cyborg literature—a person who incorporates technology into their body out of medical necessity. Susan Elizabeth Ryan notes that cyborgs in literature are often the "product of some trauma to the body."[120] But in the case of Cyborg the comic book character, technological augmentation serves as a way to overcome injury and trauma. Similar motifs can also be found in

[118] DC Comics, "Character overview," accessed January 10, 2019, https://www.dccomics.com/characters/cyborg.
[119] DC Comics, Ibid.
[120] Ryan, *Garments of Paradise,* 58.

science fiction, such as "The Bionic Woman,"[121] and "The Six Million Dollar Man,"[122] which both feature main characters who gain technological super-powers after traumatic accidents. A parallel to these narratives of technology as empowering, can be found in commercial wearable technology, in the field of assistive tech.

Medicine is perhaps the most visible field where we see technology integrated into the body today, with famous amputee-athletes like Oscar Pistorious[123] and Brenna Huckaby[124] demonstrating the competence of contemporary prosthetics, and models such as Mama Cax increasing visibility of people with different abilities (and prosthetic designs) in the fashion world.[125] It is interesting to consider how prosthetic intervention is deemed socially acceptable if there is a medical need for it, but not otherwise. This was a point which emerged through conversations that I had with a group of high school students in a series of workshops on wearable technology,[126] which I will detail further in Chapter 8. While all of the students were supportive of body augmentation for individuals with an obvious need, such as an amputee, many felt uncomfortable to see someone using prosthetics unnecessarily. Perhaps in recognition of the prevailing attitude toward prosthetics and need, in a lecture delivered at RPI in 2016, STELARC

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[121] Kenneth Johnson, creator, *The Bionic Woman*, Harve Bennett Productions, 1976–1978.
[122] Kenneth Johnson, creator, *The Six Million Dollar Man*, Harve Bennett Productions, 1974–1978.
[123] Pistorious's success as a runner generated a controversy, when some writers asked whether his superior prosthetics gave him an advantage over amputee athletes with less financial means (1). It should also be noted that in 2016, Pistorious was imprisoned in South Africa for the crime of murdering his wife in 2013 (2).
Sources: (1) Rose Eveleth, "Should Oscar Pistorius's Prosthetic Legs Disqualify him from the Olympics?" *Scientific American,* July 24 2012, accessed December 8, 2015, http://www.scientificamerican.com/article/scientists-debate-oscar-pistorius-prosthetic-legs-disqualify-him-olympics/. (2) Alan Cowell, "Oscar Pistorious's Murder Sentence Is Increased to 15 Years," *The New York Times*, November 24, 2017, accessed January 15, 2019, https://www.nytimes.com/2017/11/24/world/africa/oscar-pistorius-sentence.html.
[124] "Team USA," accessed January 15, 2019, https://www.teamusa.org/para-snowboarding/athletes/Brenna-Huckaby.
[125] Laura Regensdorf, "This Model-Activist and Amputee's Runway Walk Just Lit up the Chroma Show," *Vogue,* September 7, 2018, accessed January 15, 2019, https://www.vogue.com/article/mama-cax-model-disability-amputee-new-york-fashion-week-chromat-spring-2019.
[126] Kathleen McDermott, *Critical Wearable Workshop Series,* (Albany, NY: Tech Valley High School, 2016), RPI IRB:1489.

put forward the idea of the, "prosthetic not as a sign of lack but as a symptom of excess."[127] The artist showed designs, created in collaboration with a robotics research team, for a prosthetic hand with joints that could bend forward, as well as backward. The work begs the question, why should prosthetic design seek to emulate the functionality of a human body, but go no further? Why shouldn't prosthetics allow people with different abilities, such as those who have amputated limbs, to achieve new and different capabilities with their bodies, beyond replicating those which other people achieve "naturally?" Further, why shouldn't wearable technology allow people with no overt "need" for prosthetic intervention, achieve new and different capabilities with their bodies? Why shouldn't we think of the prosthetic as an opportunity?

The most obvious counter to this line of thinking, beyond the fears which surround the possibility of cyborg accident, can be found in the issue of unequal access to the enormous amount of resources required for prosthetic transformation. As science fiction writer William Gibson once observed, "The future is already with us, it's just unevenly distributed."[128] If the only model of a productive cyborg relationship hinges on expensive, robotics-based interventions, then we can quickly see the limits of the transformative claims of cyborg identities. However, as countless theorists have shown, positive understandings of the cyborg identity can take many forms, and don't require literal physical changes to the body. Allucquére Rosanne Stone, referring to her first experience using radio, writes, "sending a whole part of myself into the ether…that's a

[127] STELARC, "The Involuntary, the Automated and the Uncanny: Zombies, Cyborgs and Chimeras," lecture, School of Architecture Lecture Series, Rensselaer Polytechnic Institute, Troy, NY, May 2, 2016.
[128] Pagan Kennedy, "William Gibson's Future is Now," *The New York Times Sunday Book Review,* January 13, 2012, accessed March 1, 2019, http://www.nytimes.com/2012/01/15/books/review/distrust-that-particular-flavor-by-william-gibson-book-review.html?_r=0 . (Kennedy notes the quote has been attributed to Gibson but that no source exists. Margaret Atwood also attributes this quote to Gibson, as did Stelarc in a recent talk at RPI.)

prosthesis,"[129] and goes on to explain her relationship with radio as an, "extension of my instrumentality." Stone's experience relates to idea of technology as being transformative, even spiritual. It may relate to Jane Bennett's theory of thing-power, "Thing-power gestures toward the strange ability of ordinary, man-made items to exceed their status as objects and to manifest traces of independence or aliveness, constituting the outside of our own experience."[130] Objects don't have to be extraordinarily high-tech for humans to form meaningful, transformative, cyborgial relationships with them.

To that end, it is useful to consider ways in which garments and fashion, which can be considered a form of wearable technology, can exhibit spiritual and transformative qualities. Margaret Atwood draws a connection between special garments and periods of transition, noting that college graduates wear robes to their ceremonies, and move the tassels on their mortarboard caps from right to left in order to signify their shift from student to graduate after receiving their diplomas. Similarly, in order to transition from Bishop to the all-powerful Pope in the Catholic Church, one must be given, "the Fisherman's Ring, the wearing of which grants him, in the eyes of believing others, a huge amount of spiritual power that the individual man would not have without this symbol."[131] Some of Atwood's numerous other examples of transformative garments include those worn by athletes, royalty, comic book characters, and characters in Greek mythology. Atwood's examples of transformative garments, hold very different affective qualities than what we see in most commercial wearable technology. They relate to memory, tradition, spirituality, imagination, and faith. They often express a history. In contrast, commercial wearable electronics,

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[129] Allucquére Rosanne Stone, *The War of Desire and Technology at the Close of the Mechanical Age* (Cambridge, MA: MIT Press, 1996), 3.

[130] Jane Bennett, *Vibrant Matter: A Political Ecology of Things* (Durham, NC: Duke University Press: 2010), xvi.
[131] Margaret Atwood, *In Other Worlds: SF and the Human Imagination* (New York: Anchor Books, 2011), 25–26.

as I will show, tend to seek usefulness in a contemporary sense of the word, a goal which is ultimately to make the human body more machine-like, and better suited to work.

3.4. Embracing Contradictions Through Absurdity

I have sought to show that wearable technology may be viewed as a bastion of an undesirable future, one in which humankind's relationship to technology becomes less of a choice, and more of a force for control; but it may also be viewed as an empowering tool, enabling people with different abilities to move differently through the world, and allowing a broader spectrum of personal identities to be expressed. Both of these understandings hold truths. In order to avoid falling too far into one or the other binary, a techno-utopia or dystopia, and in an effort to foster productive conversation that touches on both possibilities, I have applied the absurdist electronics method to wearable technology design.

As Scott Bukatman has observed, technology is inherently related to change, and this often puts it at odds with culture, which may experience tension between forces that wish to embrace change, and those that seek to preserve the status quo.[132] Frederic Jameson has argued that Postmodernism is defined by tension caused by technology that has developed more quickly than humankind's ability to process it.[133] Humans adapt to and embody new technologies, while simultaneously attempting to cling to notions of identity and culture from earlier eras. An interest in grappling with a changing reality caused by technology was one of the main features of

[132] Scott Bukatman, *Terminal Identity: The Virtual Subject in Post-Modern Science Fiction* (Durham, NC: Duke University Press, 1993), 3. These ideas are further explored in the chapter that follows.
[133] Fredric Jameson, *Postmodernism, or, The Cultural Logic of Late Capitalism* (Durham, NC: Duke University Press, 1991).

Surrealism, and its predecessor movement, Dada. Norman Bryson argues that contemporary artists must continue to grapple with what he calls, "Surrealism's unfinished project," a need to reconcile the changes happening in an exterior world with the "modernized" unconscious.[134] By incorporating absurdity into wearable technology, it is possible to create moments of humor, shock, or confusion, that may allow a viewer or participant to temporarily suspend their cycle of anxiety related to technological change, and to examine their present conditions with fresh clarity. Absurdity applied to wearable technology may present an unexpected intersection, where public attitudes toward the body and technology may be productively explored. Further, the instructional format of the absurdist electronics method, invites observers to actively participate in exploring these questions, through design.

The investigations that follow are to some degree a continuation of a line of thought I began while completing my MFA thesis, which included a series of three wearable electronic artworks designed to playfully address social issues in public space, which I gathered under the title *Urban Armor*. The most prominent of these works, *Urban Armor#2: The Personal Space Dress* (2014), a robotic dress that expands when someone comes too close to the wearer, was picked up by major news outlets such as The Guardian, The Wall Street Journal, and The Huffington Post, when I posted a video of the dress being worn on the Hong Kong subway (fig 3.2). The viral response to the video seemed to be related to the fact that the object actually functioned, but the film felt constructed, and so viewers were unsure whether to react to the design as a fiction or as a product. Online commentators responded with a range of emotions, some felt threatened by the idea of

[134] Norman Bryson, "The Unfinished Project of Surrealism," in *Hyper Mental,* ed. Pollock and Heinrich (Zurich: Kunsthaus Zurich, 2001), 15-18.

encountering robotic appendages on the subway and considered it selfish,[135] while others appeared eager to embrace the object, writing, "I need that!"[136] Still others understood the object as an artwork, and read symbolic meaning into it as an object relating to issues of sexual harassment.[137] The success of this work in promoting conversation online has sparked my interest in understanding the phenomenon further and informed my research questions, enabling me to examine the polarizing effect of wearable technology with more intentionality in the case studies that follow.

Figure 3.2: Kathleen McDermott, *Urban Armor #2: The Personal Space Dress*, 2014.

[135] Priscilla Frank, "The 'Personal Space Dress' Could Help Solve All Your Public Transportation Woes," *Huffington Post*, May 19, 2014, accessed March 1, 2019, http://www.huffingtonpost.com/2014/05/19/personal-spacedress_n_5340519.html?utm_hp_ref=arts&ncid=fcbklnkushpmg00000027.

[136] Shaunacy Ferro, "Ward off subway goers with this expanding dress," *Fast Co Design*, May 12, 2014, accessed March 1, 2019, http://www.fastcodesign.com/3030424/expanding-dress-foilsstrangers-who-try-to-invade-your-personal-space079/1/?ref=HRESS-7#1.

[137] Jackie Bischoff, "This Dress Makes People Stand Back, Really," *The Wall Street Journal,* May 27, 2014, accessed March 1, 2019, http://online.wsj.com/articles/this-dress-makes-people-stand-back-really-1401237062.

4. ABSURDIST ELECTRONICS, DESIRE, AND USEFULNESS—URBAN ARMOR # 6: THE CINNABROOCH

4.1 Technology and Objects of Desire: Efficiency and Streamline

At a recent exhibition at the Art Institute of Chicago featuring objects created by Danish silversmith Georg Jensen in the early 20th Century,[138] I was struck by the ability of static objects to incite desire in myself as a viewer. The show featured smooth, reflective water pitchers and shining silver salt and pepper shakers that provoked a kind of duel desire: 1. A consumer desire to purchase and possess the objects; so that I may look at them and invite my friends over to look at them, encouraging them to admire the implied success of a home filled with domestic objects that look like they've never been touched by a human hand; 2. A desire that feels closer to a sexual desire, to touch the objects and feel the cool, pore-less, reflective metal, and to perhaps attain some of the strength that seems to project from their pristine surfaces.

Human desire for objects may reflect something of a wish on the part of the person who yearns for them, manifested in the promise the object holds to improve oneself, to make oneself more desirable, to distract oneself, or simply to allow oneself to fall into the void of their own reflection. We project ourselves onto objects. But objects such as Henning Koppel's *Eel Dish* (Fig 4.1), offer a peculiar aspiration: a surface without a porous membrane, so symmetrical as to indicate a disconnect from organic practices of production—it is an appearance achieved through hundreds

[138] Georg Jansen, *Georg Jansen: Scandinavian Design for Living,* Art Institute of Chicago, June 20–Sept 9, 2018, accessed March 24, 2019, http://www.artic.edu/exhibition/georg-jensen-scandinavian-design-living

of hours of labor, according to the manufacturer's website.[139] Although it is made by hand, *Eel Dish* reflects some of the aesthetic values of the design movement streamline, a style which has roots in aeronautic and maritime research on minimizing wind resistance. This association allows streamline to become a visual shorthand for "high performance," even when the object in question, such as a covered dish, requires no streamlining because it will be used at rest. By some accounts, the popularity of streamline within the design of domestic objects, where it is referred to as Streamline Moderne, emerged not only out of a desire to reference an aesthetic of high performance, but also out of a practical need, which emerged during the 1930's, to produce domestic objects cheaply. Architectural historian Richard Poulin describes streamline as, "a reflection of austere economic times. Unnecessary ornament was gone, sharp angles were replaced with pure, aerodynamic forms visually communicating a smooth, frictionless, and machine-driven progress, with exotic and expensive materials replaced by concrete and glass."[140]

According to Alexandra Midal, however, the values implicit to streamline extended beyond practical production concerns, to reflect a larger obsession in the United States in particular, with efficiency and self-improvement. Alexandra Midal writes, "Curiously, streamline is the design movement that undoubtedly arouses the widest range of interpretations, among which sits enthroned the promise of eradicating the difficulties and frictions in society in general, facilitating consumption, simplifying existence…"[141] Midal cites Christina Cogdell, who draws a parallel between the aesthetics of streamline, it's obsession with "efficiency, hygiene, and the realization

[139] https://www.georgjensen.com/en-us/tableware/serveware/eel-dish-1054/3522728.html, accessed March 24, 2019.
[140] Richard Poulin, *Graphic Design and Architecture*, 97.

[141] Alexandra Midal, "Tomorrow Now- When Design Meets Science Fiction," in *Tomorrow Now–When Design Meets Science Fiction,* ed. Alexandra Midal (Luxembourg: Mudam Luxembourg, 2007), 15.

of an 'ideal type,'"[142] and the ideals of the eugenics movement, which sought to produce a breed of ideal humans and openly promoted racism and ableism. Cogdell explains, "Efficient living was a primary pursuit of eugenicists and progressives alike, many of whom based their life's work and even their daily habits on its principles."[143]

The aesthetic fetishization of efficiency that emerges through the application of streamline to domestic objects, is reminiscent of the values of Futurism, an artistic movement which originated in Italy in the early 20th Century and which according to Elza Adamowicz and Simona Stochi,

> …is a cultural position characterized by an enthusiasm for modernity bound up with a nationalistic ideology. Futurism's obsession with industrial and technological modernity and the imperialist outlook resulted in a rejection of democracy, a warmongering attitude and an aesthetics of speed, technology and the machine.[144]

Subsequent Dada artists, while indebted to the Futurists' usage of the manifesto and typography, rejected the glorification of technology that typified Futurism and aligned it with technologies of war.[145] Ironically, the tendency within Streamline Moderne to apply streamline to domestic objects that don't require it, is in some ways a bastardization of both Dada and Futurist values. Futurists valued function, they aestheticized mechanical parts of machines and sought to make them visible, but streamline obscures inner-workings by applying a smooth outer shell. The smooth, streamlined shell is itself a product of scientific research on aerodynamics, and is fetishized as such, but again,

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[142] Christina Cogdell, *Eugenic Design Streamlining America in the 1930s* (Philadelphia: University of Pennsylvania Press, 2004), 4.
[143] Christina Cogdell, "Smooth Flow: Biological Efficiency and Streamline," in *Popular Eugenics: National Efficiency and American Mass Culture in the 1930s*, ed. Susan Currell and Christina Cogdell (Athens, OH: Ohio University Press, 2006), 220.
[144] Elza Adamowicz and Simona Stochi, "Introduction," in *Back to the Futurists: The Avant-Garde and its Legacy,* ed. Adamowicz and Storchi (Manchester, UK: Manchester University Press, 2013), 5. (The author is paraphrasing a definition by Emilio Gentile.)
[145] "They declared their rejection explicitly, sloganizing under Paris Dada that, 'The Futurist is dead. Who killed it? Dada.'" Dayfdd Jones, "La Bomba-Romanzo Esplosivo, or Dada's Burning Heart," in Adamowicz, *Back to the Futurists*, 56.

it is a technology with no use in many domestic applications. Dadaists valued nonsense and absurdity, and an aerodynamic toaster could be considered just such a gesture, although it is not intended as such. However, Streamline Moderne diverges from Futurism and Dada, which were primarily artistic movements, in its connection to commercial industry. Whether or not it invokes larger cultural values in the process, streamline applied to domestic objects is primarily a gesture aimed at reducing costs of production and promoting mass consumption through fetishizing efficiency. More than a strange sum of its influences, streamline is a site for new desire. In an analysis of the desire to have sex exclusively with machines, which has been declared by certain posthuman enthusiasts, Michael Hauskeller has observed,

> The attraction that we feel for machines, that makes us choose them as sexual partners and makes us actually wish to be machines ourselves, or at least in some respects like a machine, has been explained by the German philosopher Günther Anders as resulting from 'Promethean shame.' Promethean shame is what we feel when we realize that the machines we have created are so powerful and perfect that we humans with our messy and mortal bodies cannot but feel very deficient in comparison.[146]

Again, the desire to both be with a machine and to be more machine-like, is one which relates to the ideals of Futurism, which Claudia Springer writes, "fetishized the speed and powerful force of industrialized machines from about 1909 until 1914."[147]

Returning to Koppel's *Eel Dish* (Fig 4.1), what coded promise did I respond to in such a sleek, reflective, unblemished, object? What kind of domestic space could I imagine this piece existing in? A home that visually belies no signs of the efforts that are required to keep it running? A home filled with objects that look like they've never been used? When considering the impact of

[146] Michael Hauskeller, *Sex and the Posthuman Condition* (London: Palgrave MacMillan, 2014), 41.
[147] Claudia Springer, *Electronic Eros: Bodies and Desire in the Postindustrial Age* (Austin: University of Texas Press, 1996), 1.

streamline on fashion and wearable technology design, the mind can quickly jump from a desire for a perfect silver dish, to a desire for a body that shows no signs of "use," no lines from aging, no visible pores, and no excess weight.

Figure 4.1: Henning Koppel, *Eel Dish*, model 1054, designed in 1956 and produced in 2015.[148]

[148] "Eel Dish," Art Institute of Chicago, accessed December 27, 2018, https://www.artic.edu/exhibitions/2825/georg-jensen-scandinavian-design-for-living

Indeed, the impulse to apply the values of streamline (sleek, clean exteriors which obfuscate any signs of work) to the human body, has been shown by Susan Elizabeth Ryan, in her primer on the history of wearable technology design. Ryan points to a 1939 *Vogue* issue devoted to that year's New York World's Fair, which had a futuristic focus. Designers tasked with visualizing clothing for the women of the future focused on making clothing light and minimal, in order to reveal what they imagined would be the perfectly engineered bodies of the future woman. Ryan quotes designer William Sakier as saying, "The woman of the future will be tall, slim and lovely, she will be bred to it."[149] Another writer adds, "She may be gentle, sympathetic, understanding–because of a determinable combination of genes,"[150] a prediction which corroborates Cogdell's account of the relationship between eugenics research and the aesthetics of streamline.

While eugenics and Futurism fell out of favor in the second half of the 20th Century, largely due to their connection with Fascism and Nazism,[151] Dunne and Raby argue that commercial technology design continues to reproduce conservative values in more subtle ways. They claim that narratives constructed around designed technologies tend to reproduce cultural stereotypes, because advertisers seek to strike a tone that is extremely familiar in their sales pitches—lest the newness of the technological objects they are selling, should frighten potential consumers with the prospect of cultural change. Advertisers in this scenario, whether consciously or not, are trying to mitigate the effects of what Toffler calls "future shock," a feeling of culture shock within one's

[149] Susan Elizabeth Ryan, *Garments of Paradise: Wearable Discourses in the Digital Age* (Cambridge, MA: MIT Press, 2014), 31.
[150] Ryan, *Garments of Paradise,* 30.
[151] Anne Bowler, "Politics as Art: Italian Futurism and Fascism," *Theory and Society* 20, no. 6 (1991): 763.

home culture, and "a product of the greatly accelerated rate of change in society."[152] It is without a doubt that major technological innovations, when widely adopted, ultimately have an effect on culture. (The Beatles sporting electric guitars and shaggy haircuts on *The Ed Sullivan Show* in 1964, broadcast into the home of millions, is often used as an example of the way in which television contributed to the spread of counterculture, and with it, alternative forms of desire, in the 1960s.)[153] So, to mitigate consumer fears, Dunne and Raby argue, advertisements for new technologies are often committed to reinforcing the upper-middle-class, Western nuclear family and with it, the status quo. In mainstream efforts to incite consumerist desire, they write, "there is no room for doubt or complexity...Everyone is a stereotype, and social and cultural roles remain unchanged."[154] In the case of mass-produced products, they argue, "design works to keep official values in place."

Dunne and Raby see potential to subvert and complicate mainstream, consumerist desire toward objects, through misuse and transgression. In the context from which Dunne and Raby are writing (upper-middle-class UK), the authors observe that many of their "basic needs are met," leaving a, "desire to satisfy more abstract ones," which may move beyond ideas of "wellness," to explore, "transgression, danger, and excitement."[155] Desire, Dunne and Raby argue, is something which may exist outside of a product's usefulness or use-value. Indeed, because desire is often experienced instinctively, through a person's sensory properties, desire may be prompted through qualities such as touch and smell, which have no obvious relation to the functionality of the

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[152] Alvin Toffler, *Future Shock* (New York: Bantam Books, 1990), 11.

[153] Kenneth Bindas and Kenneth Heineman, "Image is Everything: Television and the Counterculture Message of the 1960s,"*Journal of Popular Film and Television* 22, no. 1 (1994): 22-37.

[154] Anthony Dunne and Fiona Raby, *Design Noir: The Secret Life of Electronic Objects* (Berlin, Germany: Birkhäuser, 2001), 6.

[155] Dunne and Raby, *Design Noir,* 52.

designed object. A parallel can be found between Dunne and Raby's interest in producing more complicated models of desire between people and designed technologies, and philosophical positions which relate technology to expanded possibilities for gender and sexuality.

4.2 Alternative Models of Technology and Desire

Springer argues that in the early 20th Century, in part as a byproduct of Futurism, conservative gender binaries were reflected in cultural attitudes towards technology. Machinic technological objects were associated with "virile masculinity," while ships and planes (which must be entered and tamed) were cast as female, creating, "sexual tension with their crews."[156] But this binary has become more complicated as technology has evolved, and become entangled with the body in different ways. Springer argues, "popular culture plays out contemporary cultural conflict over sexuality and gender roles in its representation of cyborgs."[157] She goes on to explain that the "man-of-steel cyborg," (her term for a style of cyborg representation that is aesthetically aligned with the film *The Terminator,* a powerful pairing of machine and body), was a hold-over from the industrial age, which sexualized machinic power. However, Springer argues that the relevancy of the "man-of-steel cyborg," has faded, as we have shifted to an era defined by nanotechnology and computation, which have a very different aesthetic of power.

Indeed, the impact of industrial technology and now computational technology on human desire is more complex than a simple rejection of the organic, and a fetishization of the machinic. As the idea that human development has been irreversibly altered by technology becomes broadly

[156] Springer, *Electronic Eros,* 9.
[157] Ibid, 10.

accepted, binary arguments surrounding desire and nature begin to break down. As Manual De Landa has observed, scientific theories such as Darwinism were overly applied to human history in the 20th Century. Darwinism implies that there can only be one outcome in the natural world, and that the "right" one (the fittest one) will always emerge. But as human surroundings continue to grow more complex, requiring the ability to interface with the diverse byproducts of a constructed environment, "natural" fitness becomes harder to evaluate, and a "fixed criterion of optimality disappears."[158]

A similar logic is present in Haraway's *Cyborg Manifesto*, which acknowledges the complex roots of cyborgs as the "illegitimate offspring of militarism and patriarchal capitalism,"[159] but nonetheless maintains that a cyborg identity, "can suggest a way out of the maze of dualisms in which we have explained our bodies and our tools to ourselves."[160] Haraway's theory implies that a recognition of the fact that human evolution has been complicated by technology, can neutralize the limiting logic of both Darwinism and creationism. She writes, "The cyborg would not recognize The Garden of Eden; it is not made of mud and cannot dream of returning to dust."[161] Haraway's manifesto has had implications in queer theory, gender theory and critical race studies, where it has both offered a framework for combatting dualistic stereotypes rooted in Humanism, as well as been criticized for overstating the ability of the cyborg figure to serve as a transformative force.[162] One way in which the complex relationship between human sexuality and technology

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[158] Manuel De Landa, *A Thousand Years of Nonlinear History* (Brooklyn, NY: Zone Books, 1997), 14.
[159] Donna Haraway, "A Manifesto for Cyborgs: Science, Technology and Socialist Feminism in the 1980s," in *The Haraway Reader* (New York and London: Routledge, 2004), 10.
[160] Haraway, "A Manifesto for Cyborgs," 39.
[161] Ibid, 9.
[162] Ed. Gill Kirkup, Linda Janes, Kathryn Woodward, Fiona Hovenden, *The Gendered Cyborg: A Reader* (London: Routledge, 2000). [Note: a repeated theme in this collection of essays is a sexist representation of cyborgs and women in science fiction. It is implied in the introduction that these representations are evidence of the limitations of Haraway's cyborg, "Its usefulness for cultural deconstruction of gender has become apparent, but its usefulness as a tool for material change is yet to be proved." (Gill Kirkup, "Introduction," 5). But I would disagree. The fact that there may be a shortage of empowering images of cyborgs for women and people of color is not evidence that the

alluded to by Haraway, can be illustrated, is through sex toys and prosthetics, which physically play a role in sex between human partners, and may also be the sole site of a sexual encounter. Furthermore, Allucquére Rosanne Stone notes how sex and desire can also be produced telematically, pointing to how phone sex workers are able to simulate and compress all of the sensory interactions associated with physical sex, through only the auditory sense. People on other end of the phone line receive and unpack this transmission:

> The sex workers took an extremely complex, highly detailed set of behaviors, translated them into a single sense modality, then further boiled them down to a series of highly compressed tokens…At the other end of the line the recipient of all this effort added boiling water, so to speak, and reconstituted the tokens into a fully detailed set of images and interactions in multiple sensory modes.[163]

Within the brief overview above, two competing narratives of the impact of technology on desire begin to emerge: one in which narratives around technology are understood as reinforcing gender and sexual binaries, and one in which technology may support a more complicated understanding of sexual identities and encounters.

4.3 Case Study: iPhone

In what ways do the values of Futurism and streamline persist in contemporary wearable electronic design? By extension, in what way does desire become synonymous with high-performance? I would argue that the prevailing trend within industry of efficiency-enhancing

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cyborg as a medium is flawed, it is evidence that there needs to be a greater degree of creative work in this area. Haraway writes about the *possibility* of the cyborg identity. Mainstream science fiction does not represent an exhaustion of this possibility.]

[163] Allucquére Rosanne Stone, *The War of Desire and Technology at the Close of the Mechanical Age* (Cambridge, MA: MIT Press), 1996, 7.

wearable technologies, (which I will further illustrate in the chapter that follows), perpetuates an erotics of usefulness that is indebted to Futurism. Take the iPhone, for example, (which can be considered wearable, because it is almost always on the body, though often in a pocket or held, rather than worn), its exterior is so sleek and its inner-workings so obfuscated, that it is difficult for a layman to even open it. Versions 4–10 require a specialty (pentalobular) screwdriver,[164] in order to open the exterior shells and access the circuitry of the phones. The fact that one can purchase something titled the "iPhone Liberation Kit,"[165] to facilitate replacing the pentalobular screws on the iPhone with more common Phillips head screws, should give an indication as to how inaccessible the iPhone's hardware is. The aesthetic of streamline implies that the iPhone was not made into a high-functioning object, it emerged that way. This origin myth may distract consumers from the ethical and environmental implications of iPhone's production practices, as well as the environmental impact of its data usage. As James Suckling and Jacquetta Lee have noted, "The Apple iPhones consistently show an increasing impact with each successive generation, indicating the rise in complexity of the phones and their GHG emissions."[166] The "efficiency," implied by the iPhone aesthetic may apply to its ability to run an application, but it does not necessarily correlate to efficient production practices or server usage. Streamline helps distract us from these concerns, in part by inciting desire.

For example, a 2018 ad campaign for iPhone XR, features a shimmer of light emerging out of pure blackness, while a synth-heavy beat builds tension in the background. The light ray

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[164] K. Wiens, P. Corcoran, "Repairability Smackdown II: iPhone versus iPhone," in *Consumer Electronics Magazine, IEEE* 3, no.1 (2014): 19-24. https://doi.org/10.1109/MCE.2013.2284933.
[165] iFixit, "iPhone Liberation Kit," accessed October 27, 2015, https://www.ifixit.com/Store/iPhone/iPhone-4-4S-Liberation-Kit/IF182-019.
[166] James Suckling and Jacquetta Lee, "Redefining the Scope: The true Environmental Impact of Smart phones?" *The International Journal of Life Cycle Assessment* 20, no. 8, (2015): 1181–1196.

expands and is animated, it traces the delicate contour of an iPhone as it comes into focus. A quick cut reveals two phones floating weightlessly in a void, but drawn toward each other. The faces of the phones touch and rays of light emit out of them, while the music approaches a crescendo (Fig 4.2). In the next moment the phones are repelled away from each other, and reveal more phones in a burst of procreative light, all of them catching the reflection of computer-generated light rays, all of them seemingly floating in space. There is no question that Apple seeks to manufacture lust for this object, which seems to represent the peak of engineering performance and efficiency.

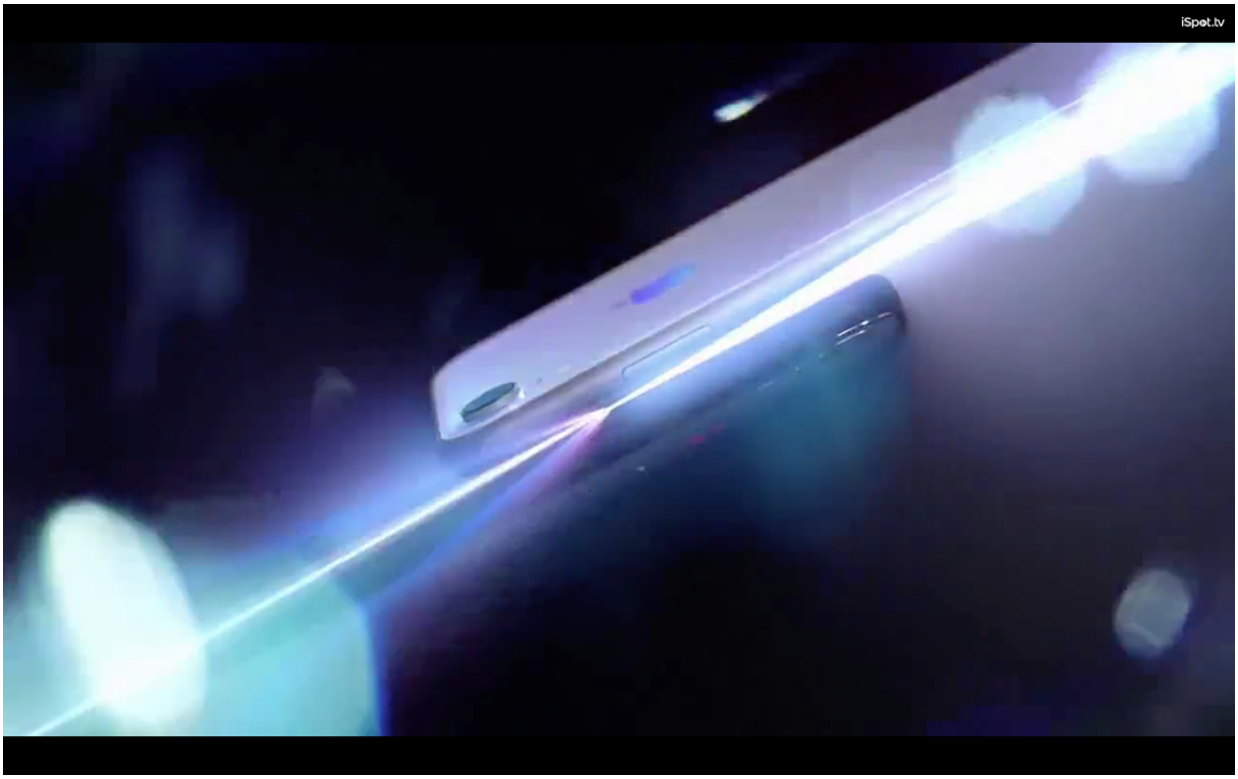

Figure 4.2: Still from iPhone XR commercial, 2018.[167]

[167] "iPhone XR Commercial 2018, ID: 1929875," accessed December 27, 2018, https://www.ispot.tv/ad/dXqv/apple-iphone-xr-spectrum-song-by-emmit-fenn.

The persistence of use-value fetish and streamline in the industrial design of wearable technology, is what necessitates the Absurdist Electronics approach, in order to disrupt a continued replication of values which would imply that to be more machine-like is the ultimate human aspiration, as well as to achieve the stated Critical Design objective of producing more strange and abstract moments of desire.

4.4 Perspectives from Dada and Surrealism on Desire and Usefulness

One of the primary ways which Dada and Surrealism sought to undermine the values of Futurism, was through manipulating common objects in ways which negated their use-value. Many of these explorations also had erotic elements. An apt example can be found in Meret Oppenheim's Surrealist object, *Fur-Lined Tea Cup (1936),* which consists of a saucer, teacup, and spoon, covered in a gradient of cream to brown-colored fur. The object is at once absurd, humorous, repugnant and seductive; it looks soft enough to incite the desire to touch, but it also completely subverts the use-value of the cup. A viewer that considers drinking from the furry vessel must be compelled to imagine the smell and texture of wet fur, and the feeling of having hair stuck on one's tongue. The transgressive nature of this object can be appreciated further, when considering the original, French title of the work, *Déjeuner en fourrure (Luncheon in Fur),* which may be a reference toward oral sex.[168] Explorations of use-value, objects, and desire can also be found in the work of Dada artist Man Ray, who used photography as a way to visually conflate the bodies of women with objects and instruments. His famous portrait, *Le Violon d'Ingres (Ingres's*

[168] Marcia Tanner, "Mother Laughed: The Bad Girls' Avant-Garde," in *Bad Girls* (catalog) The New Museum of Contemporary Art, New York (Cambridge, MA: MIT Press, 1994), 57.

Violin, 1924) depicts a seated female nude, (Kiki of Montparanasse)[169] from behind, with the *f*-holes of a stringed instrument painted onto her back. The work can be read as a conflation of the sexual attractiveness of a woman's body with the inviting qualities of an instrument asking to be played. The woman's arms are not visible, they are hugged in front of her in such a way that her torso appears limbless from behind, further complicating her agency (or usefulness) as a person. In many ways it is a misogynistic treatment of the model, an equation of her sexual attractiveness with an inanimate object. The image is complicated, however, because it also has a quality of nonsense and visual play, and its titular reference to M. Ingres may imply a critique of that artist's habit of painting nudes in uncomfortable positions.[170]

Man Ray's work highlights an important point of tension in efforts to describe Dada and Surrealist attitudes toward sexuality as avant-garde. Despite their artistic efforts to challenge institutional norms, Dada and Surrealist artists often perpetuated systems of power and subjugation in respect to women and people of color. As Mary Flannagan has observed in her analysis of *The Bride Stripped Bare by Her Bachelors, Even (1923),* Duchamp, an influential figure in both Dada and Surrealism, had a tendency to equate the female body with at best ambiguous and at worst sinister understandings of technology and machines.[171] However, while male Dada and Surrealist

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[169] Kirsten Hoving Powell, *Le Violon d'Ingres:* Man Ray's Variations on Ingres, Deformation, Desire and de Sage," *Art History* 23, no. 5 (2000): 772–799.

[170] Powell unpacks Man Rays' complex relationship with the painter M. Ingres, whom he both derides and is influenced by, as well as Man Ray's interest in an, "aesthetic of deformation and rupture," Powell, *Le Violon d'Ingres,* 772.

A similar tension is prominent in Man Ray's discussion of his experimental object *Cadeau* ("Gift," 1921), an iron with a row of nails running down the center of its face. Man Ray's work destroys the use-value of a common, household object and creates an instant visual joke, as one can imagine the futility of trying to use such an iron to smooth a garment. The gesture served as a direct, antagonist response to Futurism, which fetishized use-value. However, *Cadeau* is also sinister, if there were a use-value to the rusted, nail-covered iron, one would it assume it would be for violence. Arturo Schwarz asserts that there is also an erotic charge to *Cadeau*, quoting Man Ray as saying, "You can tear a dress to ribbons with it. I did it once and asked a beautiful eighteen-year-old coloured girl to wear it as she danced." Arturo Schwarz, *Man Ray: The Rigour of Imagination* (New York: Rizzoli, 1977), 208.

[171] Mary Flanagan, "The Bride Stripped Bare to Her Data: Information Flow + Digibodies," in *Data Made Flesh: Embodying Information,* ed. Robert Mitchell and Phillip Thurtle (New York: Routledge, 2004), 153-177.

artists often replicated gendered stereotypes in their experiments with technology, art and desire; female artists in both movements, such as Hannah Höch, Meret Oppenheim, and Leonora Carrington, offered more nuanced positions. According to Hopkins, Höch explored an erotic relationship, "between her lover, Raoul Hausmann, and his friend Johannes Baader," through a portrait of both men bare-chested.[172] She also offered more complex understandings of the relationship between technology and desire. Hopkins writes, "Finally, in her *Bourgeois Wedding Couple Quarrel* photomontage of 1919, Hannah Hoch depicts a couple who are equally infantilized, surrounded by the household gadgetry onto which their desires have been transferred."[173] Referring to *Érotique voilée* (Veiled Erotic, 1933), a photograph of a nude Meret Oppenheim behind a printing press, and a collaboration between the artist and Man Ray, Marica Tanner writes:

> The image we're familiar with, first published in the Surrealist journal *Minotaure* in 1934…was cropped at hip level. In the castrated form it perfectly embodies the Surrealist notion of the "mechanical bride,"…intimately engaging with male machinery… In its uncropped version, however, the reading changes dramatically…the wheel's handle protrudes precisely at groin level, endowing her with an iron phallus.[174]

4.5 Case Study: *Urban Armor #6: The Cinnabrooch*

The case study that follows will examine an original artwork produced as part of this dissertation research, *Urban Armor #6: The Cinnabrooch,* a wearable mechanical leaf shutter that opens and closes to reveal a cinnamon bun, the speed of which is based on how much the wearer

[172] David Hopkins, "New York Dada: From End to Beginning," in *A Companion to Dada and Surrealism*, ed. David Hopkins (Hoboken, NJ: Wiley Blackwell, 2016), 113.
[173] Ibid.
[174] Marcia Tanner, "Mother Laughed," in *Bad Girls,* 59.

is sweating. *The Cinnabrooch* represents an alternative aesthetic to the sleek, clean objects of streamline, primarily because it incorporates food into its design, an organic material which is messy, smelly, and can break down quickly. *The Cinnabrooch* offers none of the promises of peak performance that are present in commercial wearable technology, yet it still engages with desire.

4.5.1 Background

The goal of *Urban Armor #6: The Cinnabrooch* was to conduct an exploration of wearable electronics and desire, by attempting to ingratiate those in the vicinity of the wearer, through a strange, smelly appendage. The idea for this piece was initially influenced by an *Atlantic Monthly* article by Eric Schlosser, author of *Fast Food Nation*, which focused on how both artificial flavors and smells are manufactured chemically for numerous fast food chains and packaged food brands, at facilities such as International Flavors and Fragrances (IFF) in New Jersey. Schlosser explains that signature "smells," associated with brands like Burger King and McDonald's, are often the result of an additive which has no connection to the composition of the food product, yet are likely to have a bigger impact on the diner's impression of the food's taste than other ingredients: "Indeed, 'flavor' is primarily the smell of gases being released by the chemicals you've just put in your mouth. The aroma of a food can be responsible for as much as 90 percent of its taste."[175] Schlosser also points to the effect of smell on memory and association, and how exploiting sense of smell might be useful for creating lifelong customers.

The taste and smell additive industry are in effect, a professional exercise in manufacturing desire, making processed foods an apt starting point for my exploration into wearable electronics

[175] Eric Schlosser, "Why McDonald's Fries Taste So Good," *Atlantic Monthly* 287, no. 1 (2001): 53.

and desire. As Schlosser explains, because the laboratory-made chemicals in food additives were derived from an organic source at some point, and because different brands use different chemical compositions, the ratios of which they protect as industry secrets, many food labels use the term "natural flavors," to account for an array of chemical compounds, without detailing them specifically.

Because fragrances are added to many processed foods, and not naturally produced as a byproduct of their cooking processes, it is conceivable that fragrances could also be added to the air around fast food restaurants. This is a possibility that has captivated internet conspiracy theorists since at least 2011, particularly in regard to the sandwich chain Subway, which has a very distinct smell—allegedly from baking previously frozen bread. The smell lingers on customers' bodies for so long after visiting a shop, that it has raised suspicion on online forums like Reddit, where the question, "What is the Subway Smell?" has prompted 1,700 comments.[176] In a chapter titled, "Designing Smell into the Consumer Experience," authors Medway and Warnaby acknowledge the Subway artificial smell conspiracy but imply that it is "hyperbole,"[177] citing a blogger who interviewed a Subway representative named Mark Christiano in 2011:

> I asked Christiano what makes that smell so, well, distinctive, and he said that there was no intentional plan to make it smell the way that it does, and that it's just the result of "a combination of the baking process and the percentage of different ingredients."[178]

[176] "What is the subway smell?" accessed January 2, 2019, https://www.reddit.com/r/AskReddit/comments/lvs27/what_is_the_subway_smell/.
[177] Dominic Medway and Gary Warnaby, "Designing Smell into the Consumer Experience," *Designing With Smell: Practices, Techniques and Challenges*, ed. Victoria Henshaw, et al. (New York: Routledge, 2018), 124.
[178] Tom Roston, "What's Behind the Subway Bread Smell?" *Foodrepublic.com*, December 7th, 2011, accessed January 2, 2019, http://www.foodrepublic.com/2011/12/07/whats-behind-the-subway-bread-smell/.

However, Medway and Warnaby go on to identify retailers that openly pump scents into their stores in an effort to attract and retain customers, such as American clothing retailers Hollister and Abercrombie; as well as manufacturers which produce custom scents for retail environments, such as ScentAir.[179] The authors identify the possible benefits of this practice, acknowledging the positive cognitive associations customers may make with scents, while wrestling with the ethical implications of manipulating consumers through smell:

> On the one hand, it could be argued that the purposeful introduction of any sensory stimulant with intent to alter the behavior of consumers demands their informed consent. Conversely, it could be argued that by entering a retail store or booking a plane flight with a company that intentionally uses olfaction in this manner, then the consumer is providing a tacit agreement to be subject to the relevant consumer experience, whatever legal actions or sensory stimulants that might entail.[180]

The authors ultimately conclude that the practice is "complex." And indeed, while some companies are in a position to acknowledge the fact that they manufacture scents for their retail environments without effecting public perception of their products, (the smell of cologne in Abercrombie doesn't necessarily imply anything about the fabrication process of its clothing), the issue is more complex when it comes to the food service industry. Acknowledging that the subway bread smell is artificial, would essentially be an admission to the fact that the food is also artificial. Based on Schlosser's reporting, the "different ingredients," that the Subway representative cited by Medway and Warnaby declined to name in the bread, may very well refer to chemical compounds. One of these could be an olfactory compound. But if the compound is released during the process of defrosting, (i.e. "baking") previously manufactured frozen bread, then Subway can reasonably claim that its signature smell is in fact produced by the bread-baking process. In any case, the true

[179] Scentair, accessed January 2, 2019, https://www.scentair.com/.
[180] Medway and Warnaby, "Designing Smell," 124.

origin of the bread smell doesn't really matter. What matters, when it comes to manufactured desire, are the stories we tell ourselves.

I do not have a positive association with the Subway smell myself, perhaps because I don't like their sandwiches very much. However, one fast food chain which does captivate me, is Cinnabon®, and particularly their product, the Cinnabon® Classic Roll. Under a fullwidth image of the Classic Roll (fig 4.3), a caption on the company's website reads as follows:

> The roll. The myth. The legend. That superior flavor and unmistakable, far-reaching aroma comes from Makara® Cinnamon, which originates in the mountains of West Sumatra, Indonesia. Combined with our smooth, tender dough and fluffy signature frosting, this isn't your average cinnamon roll.[181]

This short product biography immediately acknowledges the connection between desire, aroma and myth. Cinnabon has gone so far as to trademark their cinnamon blend, to ensure that its aroma will only be associated with their products. Similarly to Subway, Cinnabon executives have gone on the record assuring the public that the smells outside their store are byproducts of its baking process, "Cinnabon…places ovens near the front of its stores so the enticing smell of warm cinnamon rolls escapes when oven doors open, says Kat Cole, (former) president of Cinnabon, a unit of Focus Brands Inc."[182] But like Subway, Cinnabon operates on a franchise model, and in order for a franchise to produce consistent products across thousands of stores run by unrelated individuals, most of the product must arrive pre-manufactured. It is highly possible that there is another element in the dough, one that is chemically derived, that is contributing to the distinctive

[181] "Bakery Menu," Cinnabon, accessed January 2, 2019, https://www.cinnabon.com/bakery-menu/cinnamon-roll.
[182] Sara Nassauer, "Using Scent as a Marketing Tool, Stores Hope It—and Shoppers—Will Linger," *The Wall Street Journal,* March 20, 2014, accessed January 2, 2019, https://www.wsj.com/articles/using-scent-as-a-marketing-tool-stores-hope-it-and-shoppers-will-linger-1400627455.

Cinnabon smell, but it is impossible to know for sure. The Cinnabon website features a nutrition tab, which links to a chart, in pdf form, detailing the calorie count of its products. The Classic Roll contains 940 calories, and 850 milligrams of sodium.[183] However, nowhere on the site will you find an exact breakdown of the ingredients in its products.

Figure 4.3: Screenshot of full-width image of the "The Classic Roll," from Cinnabon website.[184]

Despite being aware of their artful construction of my desire, I am attracted to Cinnabon, and have been, at least since I was a preteen hanging out at the mall with my best friend. I remember the incredible craving I would get for Cinnabon as we approached the mall, the always obvious answer "yes," to the question of whether I wanted icing on top, the slow process of eating the outer edges of the bun, which became softer and pulled apart more easily as I worked my way toward its center, the warm-colored cinnamon which would be revealed between the layers, and

[183] "Nutritional Guide," Cinnabon, accessed January 3, 2019, https://cdn.cinnabon.com/-/media/cinnabon/nutrition/cinnabonnutritionalguide.pdf?v=1&d=20170901T173050Z.
[184] Cinnabon, "Bakery Menu."

then the dryness in my mouth created by the sugar and all the talking, and the uncomfortable stiffness of the plastic chair after sitting for so long—an unpleasant come-down that never deterred me from coming back. As an adult, I can acknowledge that not only does the Cinnabon possess alluring aromatic and flavor qualities, but it is also a visually seductive object, with organic-looking folds of dough, and an abundance of shiny glaze. These qualities, coupled with my own attraction to the food, contributed to my decision to use cinnamon buns as the cornerstone of my exploration of absurdist electronics and desire in *The Cinnabrooch.*

4.5.2 Anxiety, Sweat, and Smell

Aside from Cinnabon, the other main actor in *The Cinnabrooch* is anxiety-induced sweat, the presence of which determines how quickly the structure will open to reveal the bun within the brooch. My interested in anxiety-induced sweat stems in part from a pop culture claim that smell produced from anxiety sweat versus sweat from exercise has a different and worse aroma. An article in *Men's Health Magazine*, states that stress sweat is emitted from the "apocrine glands, usually found in your armpit area," while sweat produced through exercise comes from eccrine glands, a difference which may explain why stress sweat smells worse.[185] This article, and my intuitive experience with anxiety sweat, are focused on the experience of the person who is sweating. When experiencing anxiety, it is understandable that we may be painfully aware of our own bodies and smells. But is this a condition that is perceptible or impactful to others? Numerous controlled studies have suggested that the answer is yes. Although people exposed to others' stress sweat may not be consciously aware of the stimuli, evidence of heightened brain responses in

[185] Alisa Hrustic, "Why Your Swear Smells So Bad When You're Stressed," *Men's Health Magazine*, April 4, 2017, accessed January 3, 2019, https://www.menshealth.com/health/a19544884/why-stress-sweat-smells-so-bad/.

controlled studies suggests that chemical communication can occur between an anxiously sweaty person, and a bystander.

In one such study,[186] anxiety sweat was collected from first-time male sky-divers, and control sweat was collected from the same male participants while exercising. Female participants then breathed in the odorless compounds, while looking at images of male faces that were neutral, ambiguous and aggressive, while the researchers collected EEG data. The study concluded that exposure to anxiety sweat can, "impact electrocortical activity that indexes sustained attention to salient environmental stimuli," suggesting a hyper-alert state while exposed to the anxiety sweat vs. the control sweat. A similar study, which collected anxiety sweat from students waiting to give oral exams, found that "chemosensory perception of human anxiety seems to automatically recruit empathy-related resources."[187] And found that heightened brain activity occurred during exposure to the stress sweat odors, specifically insula activity, which is related to "the decoding of social emotions from facial and body signals." Both studies imply that a chemical component of sweat was read by the brains of participants as a form of communication that should be paid attention to, even if participants were not cognitively aware of the signal.

Aside from the findings of these studies, which imply that human sweat emitted during periods of anxiety, may affect brain activity in people exposed to it, it is interesting to observe patterns of gender and sexual sorting in the research. Two sweat studies conducted by researchers at Ludwig Maximilian University of Munich take care to emphasize that all study participants were

[186] Denis Rubin et al., "Second-hand stress: inhalation of stress sweat enhances neural response to neutral faces," *Social, Cognitive and Affective Neuroscience* 7, no. 2 (2012): 208 –212. https://doi.org/10.1093/scan/nsq097
[187] Alexander Prehn-Kristensen et al., "Induction of Empathy by the Smell of Anxiety," *PLoS ONE* 4, no. 6 (2009). https://doi.org/10.1371/journal.pone.0005987

"exclusively heterosexual, on a 7-point scale." [188] Two of the four studies I have surveyed exposed only male sweat to only female participants, which seemed to be based on the idea that women would be more responsive to the odors. All four papers prominently cite a study which found that sexual "socioemotional meaning" can be communicated from men to women via sweat.[189] The researchers would likely defend their study designs with the claim that they need their data to be as specific and consistent as possible, which is valid. But it is also important to consider the ways in which sweat has been gendered, socially. Gordon Waitt, in his research on the affective qualities of sweat, has shown that sweat is treated differently according to social constructions of gender, sexuality and race, "Particular groups of people will draw on different sets of ideas of sweat as dirt in their everyday lives to create and police social and spatial boundaries."[190] In a series of interviews with young women, Waitt juxtaposes self-reported feelings of shame and self-disgust at personal sweat in public, with more comfortable feelings with sweat reported when in private or at home. "The participants reported that at home, they tended to cast off the cultural conventions of sweat and revel in their bodily sweat."[191] In another set of interviews with male participants, Waitt is clear about how this research differs from studies on the chemical properties of sweat:

> Throughout this paper, sweat is not reduced to chemical components. Rather, a visceral approach keeps the matter of sweat in play within assemblages of material (bodies, technologies, things) and expressive (ideas, desires, affect/emotions) forces. Sweat acquires meanings through the bodies and places it appears and is assembled.[192]

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[188] Katrin Haegler et al., "No Fear No Risk! Human Risk Behavior is Affected by Chemosensory Anxiety Signals," *Neuropsychologia* 48, no. 13 (2010): 3901–3908. doi:10.1016/j.neuropsychologia.2010.09.019
[189] Wen Zhou and Denise Chen, "Encoding Human Sexual Chemosensory Cues in the Orbitofrontal and Fusiform Cortices," *The Journal of Neuroscience* 28, no. 53 (2008): 14416 –14421. DOI:10.1523/JNEUROSCI.3148-08.2008
[190] Gordon Waitt, "Bodies That Sweat: The Affective Responses of Young Women in Wollongong, New South Wales, Australia," *Gender, Place & Culture* 21, no. 6 (2014): 668. http://dx.doi.org/10.1080/0966369X.2013.802668
[191] Waitt, "Bodies That Sweat," 677.
[192] Gordon Wait and Elyse Stanes, "Sweating Bodies: Men, Masculinities, Affect, Emotion," *Geoforum* 59 (2015), 37. http://dx.doi.org/10.1016/j.geoforum.2014.12.001

How people physically feel when they sweat, how they feel others react to them when they sweat, and how these experiences differ for, say, a physically fit heterosexual male, vs. a male whose body "fails to comply with contemporary ideas of professional masculinity," can help shed light on some of the qualities of sweat that go beyond the chemical. Waitt argues that, "perceptions of sweaty bodies and interpersonal exchanges triggered by the affective and emotional responses to sweat are integral to the production of gendered subjectivities."

As Waitt has shown, many of our feelings about sweat are constructed in relation to gender and sexuality. Here we may find a link to some of the literature identified at the top of this chapter, specifically Haraway, which implies that gender is constructed, and that technological intervention can potentially disrupt some of the binary patterns of gender and sexuality that are so often played out in science. *The Cinnabrooch* seeks to intervene in this space. It acknowledges the chemical impact of anxiety sweat in social interactions, as well as the power of other, manufactured smells to potentially manipulate desire. It takes advantage of a heightened state of alertness which may occur in those who are exposed to the wearer's anxiety sweat, by presenting these bystanders with an overwhelming seductive odor, as well as a compelling visual display of pastry. Designed to be worn by myself, it acknowledges the potential communicative power of female stress sweat in particular. It draws attention to female sweat, due to the fact that the device opens and closes faster when the wearer is sweating, becoming noisier and visually distracting in the process, but it also attempts to obscure female sweat with a competing aroma, complicating the association of female sweat with shame. Because *The Cinnabrooch* draws on the science of smell, as well as biometric technology in the form of a sweat-measurement sensor, but applies these products of reason to absurd ends, it is an example of the absurdist electronics method. Other apt references for artworks

which point to the affective quality of sweat include Sissel Tolaas's work with smell and fear,[193] and Paul Vanouse's work with the smell of labor.[194]

4.5.3 Design and Construction

The first version of *The Cinnabrooch* consisted of a round plastic container (modified from an old CD storage container) with holes poked through it (fig 4.4). The cinnamon bun sat inside the container, and a fan affixed to the outside was intended to help waft the bun aroma outward. The rate of the fan speed was controlled by a moisture sensor sitting inside the wearer's armpit, which measured how much the wearer was sweating. To reiterate, the relationship between the fan and the sweat sensor was intended to help with the logistical need to cover up body aroma, that many people experience in high-pressure or nerve-wracking situations. By not only masking the anxiety-laden odor, but also emitting an aroma that has likely been chemically configured to actively entice people, *The Cinnabrooch* should be doubly-effective. The fundamental ridiculousness of attempting to seduce the general public by affixing an enormous pastry to one's chest, was for me a source of humor.

[193] Sally Mcgrane, "The Odor Artist," *Wired.com*, April 4, 2007, accessed May 22, 2019, https://www.wired.com/2007/04/posts-odor/.

[194] Paul Vanouse, *Labor,* 2019, accessed May 22, 2019, http://www.paulvanouse.com/labor.html.

Figure 4.4: ***The Cinnabrooch V. 1,*** **Kathleen McDermott, 2015.**

Though the premise of intervening in a body's stress response and enticing people with a wearable cinnamon bun is fundamentally absurd, as I have explained in my methods section, it is important to me that the object functions reasonably well, in order to truly see the investigation through and qualitatively measure its impact on viewers. In the first version of *The Cinnabrooch*, pictured above, I found that the placement of the fan on the outside of the plastic housing, did not greatly affect the strength of the aroma from the cinnamon bun. Another issue I had at that time, was a large geographical distance from where I was living in Troy, NY, to a Cinnabon® franchise. Luckily, just as the Cinnabon company sells its trademarked Makara® Cinnamon blend, it also sells a trademarked scented oil, in collaboration with the company Air Wick, which I purchased and used to increase the olfactory properties of an off-brand cinnamon bun from a local bakery.

In addition to chemically enhancing the aroma of my brooch, I also decided after some consultation, to create a structure that could completely open and close, (as opposed to an enclosed structure with small air holes), so that the change in the air exposure of the cinnamon bun scent would be more dramatic when the device was triggered. The mechanical means through which I sought to achieve this was by emulating the design of a mechanical leaf shutter often used in analog cameras. The circular nature of this mechanical opening was a good fit for the cinnamon bun shape, and it also seemed to me to be a visually appealing object. The rings of a leaf shutter form a spiral that echo the construction of a cinnamon bun (Fig 4.5).

Most mechanical leaf shutters are made from thin material, such as sheet metal, and many of the references I found online for creating shutters used similarly thin material, such as tin, aluminum flashing, and paper. Aesthetically, I thought it would be more interesting to make a see-through mechanical leaf shutter, and so I sought to construct it out of clear acrylic. In some ways this was a poor decision, because acrylic sheets are not produced in gauges as thin as something like sheet metal or paper. Consequently, I had to modify the entire structure of the object, a process you can find further detailed in the tutorial, in the appendix of this chapter. The resulting mediocre shutter, which opened fully but did not completely close over the entire cinnamon bun, likely reduced the dramatic effect of the opening and closing cinnamon bun container. The mechanical leaf shutter design also necessitated a smaller cinnamon bun, and I had to cut the edges off my cinnamon bun to fit it in the structure. Despite these drawbacks, the complete object still made an impact on viewers.

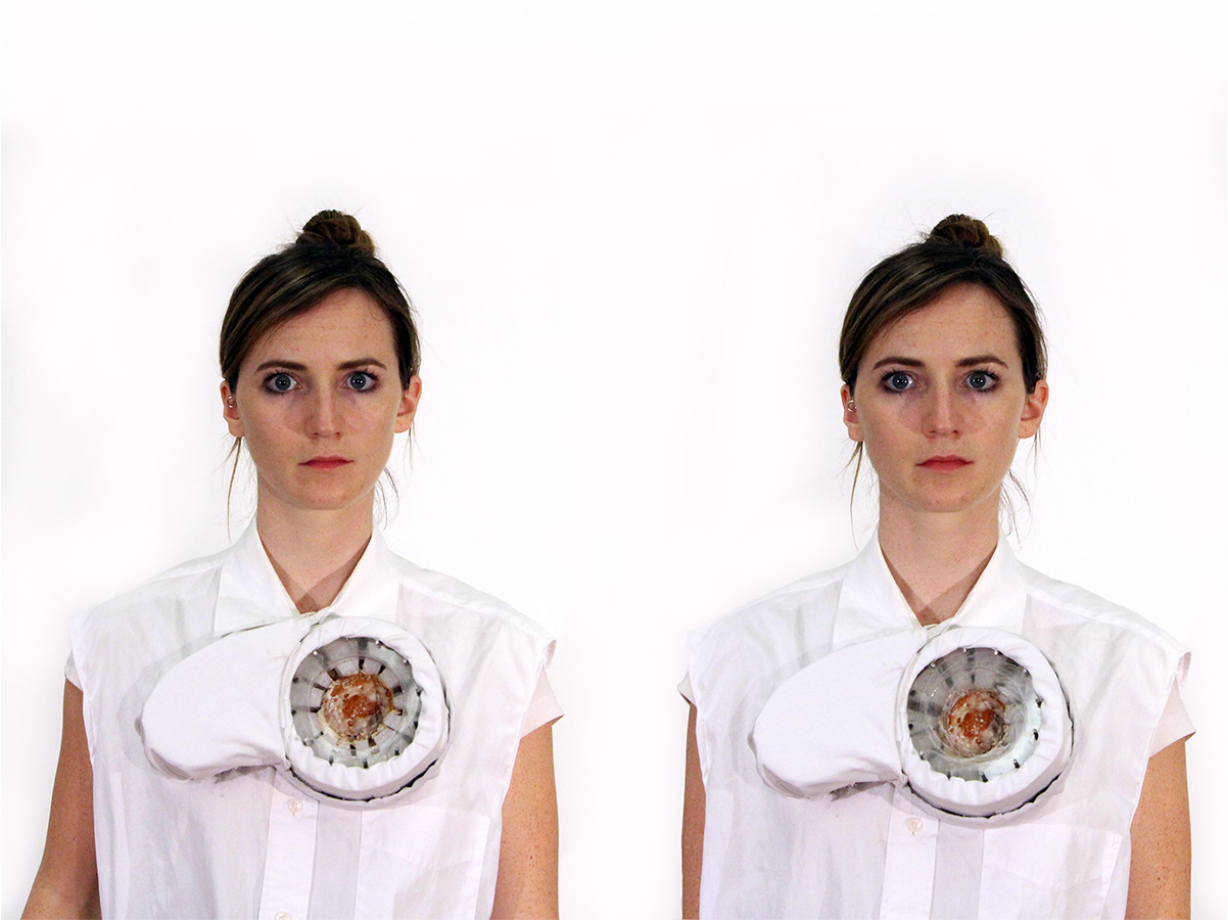

Figure 4.5: *The Cinnabrooch* V.2, Kathleen McDermott, 2015.

4.5.4 Reception and Conclusions

I wore the *Cinnabrooch* during an open studio event while in my first semester at RPI, in 2015, as well as while giving a presentation in the class, "Research Methods." The majority of the audience members during the presentation had already seen *The Cinnabrooch* during the open studio event, and I found that this inoculated them to the object somewhat. I will therefore focus on responses from people who encountered me wearing *The Cinnabrooch* for the first time, at the open studio event. At this period during my time at RPI I did not know my peers well. The presence of *The Cinnabrooch* provided a great conversation-starter with many of them, as well as with

faculty. One of my peers returned with her partner so her partner could see it. Her partner looked at me with wide eyes and said "*wow*." I was unable to decode the meaning of that response, and became more nervous. The brooch responded accordingly by opening and closing faster. When I explained the functionality of the brooch to people, as well as the fact that its pacing was linked to my rate of sweat, many people commented on how quickly the motor seemed to be operate. It was, in fact, going very fast. It also became very noisy, and felt like a third participant in conversation, one which sometimes provoked laughter. Several times during the course of the evening/performance, I became so sweaty that I had to shift the moisture sensor in my armpit to dry it, because it was beginning to short and become hot from the excess moisture, which was painful. Some people reported that they perceived a cinnamon bun aroma and others did not. Those who did not, may have perceived it (or that of my sweat), subconsciously.

One of the most interesting and visceral responses I received to the brooch, was the assertion that the object was reminiscent of an anus. The person who made this comment seemed delighted by the association, and also advised me to read William S. Burrow's *Naked Lunch.* I later attempted to do so, but did not complete the novel, because I found a lot of its graphic descriptions of drug-use unpleasant to read and imagine. I also later became aware of the frequency with which *Naked Lunch* is cited in Deleuze and Guattari's essay "How do you make yourself a body without organs?" The body without organs, or BwO, is relevant to the complicated relationship between bodies, technology and desire which I have outlined in this chapter. "The BwO is what remains when you take everything away. What you take away is precisely the phantasy, and significances and subjectifications as a whole."[195] The BwO is interested in dismantling systems of selfhood

[195] Gilles Deleuze and Félix Guattari, "Chapter 6: November 28th, 1947: How do you make yourself a body without organs?" in *A Thousand Plateaus: Capitalism and Schizophrenia*, trans. Brian Massumi (Minneapolis: University of Minnesota Press, 2003), 151.

produced by socialization, however it does not wish to leave emptiness in its place. Referring to a desire on the part of masochists and drug users to disassociate from their bodies, which could also be applied to world views that promote the disposal of the organic body in favor of a machinic body, the authors write, "Dismantling the organism has never meant killing yourself, but rather opening the body to connections and thresholds, passages and distributions of intensity…"[196] The BwO should lead to a shift in a person's sense of identity and stable body image, but not to self-destruction. In so much as it has the visual appearance of an internal organ prominently revealed, *The Cinnabrooch* is perhaps a BwOO, a body with organs outside.

There are other theories by Guattari which I have found more clearly applicable to this experiment, such as his questioning of humanist value systems applied to knowledge and communication, "The discourse of reason is the pathology…because it is the discourse of reason that is in power everywhere."[197] In research, reason is the opposite of an emotive response, it produces a reliable, measurable, replicable source of knowledge, that is given more credence than knowledge tied to emotional or embodied experiences. However, emotional communication has its own power, some of which is tied precisely to the fact that it can't be easily understood through reason. In later writings, Guattari points to dressing in drag as a highly effective and persuasive strategy of communication, "They resort to drag, song, mime, dance, etc., not as different ways of illustrating a theme, to 'change the ideas' of the spectators, but in order to trouble them, to stir up uncertain desire-zones that they always more or less refuse to explore."[198] Drag uses the powerful force of desire to challenge restrictive gender identities. It is not a written treatise steeped in the

[196] Deleuze and Guattari, "Body Without Organs," 160.

[197] Félix Guattari, "Desire is Power, Power is Desire," *Soft Subversions*, ed. Sylvere Lotringer (New York: Semiotext(e), 1996), 21.

[198] Félix Guattari, "I Have Even Met Happy Drag Queens," *Soft Subversions*, 37.

language of reason that stirs a bodily, involuntary response in its audience, it is a performance. Referring to the use of drag in the play *Hairspray*, Judith Butler claims the practice is powerful because it, "implicitly suggests that gender is a kind of persistent impersonation that passes as the real."[199]

The Cinnabrooch and its strange combination of technological and organic materials, may also have the ability to reveal the complexity of the human relationship to desire and technology, through performance. Did this object succeed in ingratiating me to my peers? I believe at the RPI Open Studios event it did. After revealing my cinnamon bun in December 2015, I felt closer to them, and I believe they felt the same. From Spring 2016 onward, my experience in the PhD program became more sociable. However, in other contexts *The Cinnabrooch* has proved less seductive, and has been met with extreme bewilderment. The contexts in which it has failed most spectacularly, have been in certain artist talks, open to the general public, where I have shown footage of *The Cinnabrooch* in succession, after videos that are less nonsensical, such as *The Personal Space Dress,* (described in the previous section). Where audiences could identify a clear "use-value" in the earlier pieces, they often failed to identify such usefulness in *The Cinnabrooch*, and this sometimes resulted in a discomfort with the object. However, it should be noted that these reactions were in relation to video documentation of the piece, which may not have fully communicated its performative effects, especially its aroma.

4.5.5 Link to Video Documentation:

[199] Judith Butler, *Gender Trouble: Feminism and The Subversion of Identity* (New York: Routledge, 1990), viii.

https://vimeo.com/148764313

4.5.6 Tutorial*:*

https://urbanarmor.org/portfolio/cinnabrooch/ (Fig 4.6).

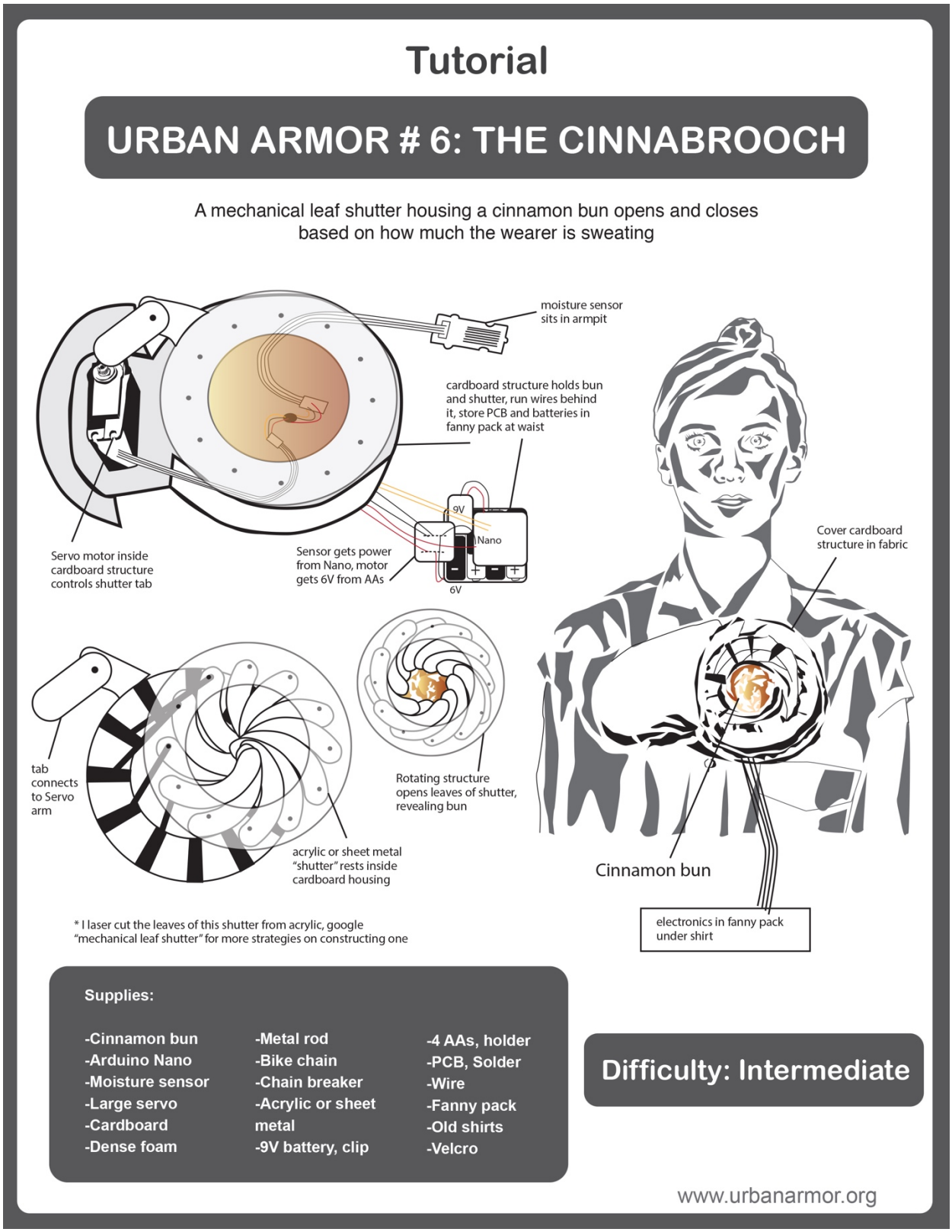

Figure 4.6: ***The Cinnabrooch*** **graphic tutorial, Kathleen McDermott, 2018.**

5. ANXIETY, EFFICIENCY, AND AN ABSURDIST RESPONSE, PART 1—*URBAN ARMOR # 7: THE SOCIAL ESCAPE DRESS*

5.1 Overview

In the previous chapter, I explored the way in which commercial wearable technology design and industrial design seek to manufacture desire through the aesthetic of streamline, which can be related to a desire to obfuscate the human body, through a drive toward efficiency. I will further explore these ideas through an examination of the way in which wearable technology acts as both a source of anxiety, through its signaling of cultural change and close proximity to the body, and also as a potential balm for anxiety, through its relationship to transformation, myth, and narrative. I will discuss two absurdist electronics case studies which respond to anxiety through wearable technology: *The Social Escape Dress,* a dress which releases a cloud of fog based on how much stress the wearer is feeling, and in part 2, *The Power Suit,* a pantsuit that inflates its arms wildly in response to loud sounds.

The Social Escape Dress is an exercise in wish fulfillment: I wish I didn't have a body all the time or that its limitations were less rigid. I wish I could disperse myself geographically. I wish, like Walt Whitman, I could be large, contain multitudes, be dirt under your feet.

I depart as air, I shake my white locks at the runaway sun,

I effuse my flesh in eddies, and drift it in lacy jags.

I bequeath myself to the dirt to grow from the grass I love,

If you want me again look for me under your boot-soles.[200]

I wish to dispense with my body so that I could commune better with the world and with things. I wish to obscure my body so that I could take the most weak-willed escape out of difficult situations, the "Irish goodbye," the abrupt exit. I wish to create a spectacle, to dazzle my friends and enemies with distraction, and to produce the opposite response of the socialized instinct to hide our moments of volatility.

But while body displacement is a wish, it is also a source of anxiety. Digitally-obsessed narratives of the future threaten to dispense with some bodies but not others, to erase the value of embodied experience, to flatten difference. Wearable and cyborg technology may act as both a source of and a response to these fears. It is a medium undoubtedly associated with the "March of Progress,"[201] and the implied threat that human evolution is pre-determined and biased toward a militaristic understanding of fitness—an idea I will explore further through discussion of commercial wearable technologies that aim to make people more efficient. Yet, through its connections to the transformative power of cloth and dress, wearable technology can also provide

[200] Walt Whitman, "Song of Myself," *Leaves of Grass,* J.R. LeMaster and Donald D. Kummings, eds., *Walt Whitman: An Encyclopedia* (New York: Garland Publishing, 1998), 78.
[201] Cameron Shelley, "Aspects of Visual Argument: A study of the March of Progress," *Informal Logic* 21, no. 2 (2001). "The so-called March of Progress, a depiction of human evolution as a linear progression from monkey to man, first appeared in the Time-Life book Early Man (Howell 1965, pp. 41-5). Since then, it has become one of the most widely recognized and dispersed icons of evolutionary biology (see Gould 1989, pp. 30-6). At the same time, it conveys a false impression about the nature of human evolution, that it may be viewed as an instance of progress through successive stages towards a future goal." (85)

a space for fantasy, and for reprieve from anxiety. *The Social Escape Dress* seeks to both examine the relationship between personal technology and anxiety, and to subvert it, by creating a cloud of fog which both visually represents the stress, and allows the body of the wearer to become abstracted.

5.2. Anxiety, Personal Technologies, and Time: "Future Shock," and The Quantified Self

Over the course of the past half century, there have been many examples of technological innovations leading to major changes in the industries in which they have been applied. Online shopping has led to the slow demise of retail stores. American manufacturing withers in the shadow of global, robotically enhanced production processes. Cable television networks give way to streaming networks. Travel agents are made obsolete by flight-finding algorithms. The list goes on. The message to companies that seek to ride out major technological change is: adapt, change, stay relevant, don't get left behind. But this message is felt by the individual as well, both as a worker and as a social being. For example, my Aunt, who is fiercely intelligent and is also a paranoid schizophrenic, struggles to maintain a working cellphone. Years ago, letters were her preferred means of communication. I have always been struck by the contrast between her articulate and sociable presence in writing, compared with her approach to conversation in real-life, which is repetitive, and relies on scripts of conversations we've had in the past, I believe as a function of her anxiety. Through our written correspondence I've come to know her differently, and better. But while she continues to send me cards, she is keenly aware of the fact that her siblings now prefer to communicate through text. She doesn't use email or social media. She once

mentioned that my cousin tried to text her pictures of her child, but she couldn't see them on her prepaid cellphone, which is lacking some of the capabilities of more expensive smartphones. Now and then she mentions a plan to get a computer, or to access her email at the library, but I know that technology has historically been a source of stress for her. When she suffers from paranoid hallucinations, the phone and the mail are the mediums through which she believes herself to be pursued, and she frequently takes her landline phone off hook. My parents, who help her manage her finances, think a computer will only become the subject of more paranoid incidents. My Aunt doesn't press the issue, but she knows she is missing out on a world that many are immersing themselves in.

It is difficult to see her left out of these societal changes, and out of this entire world of social interaction. (And confusing, philosophically, to see the idea of "schizophrenia," held up as a metaphor and abstraction in media theory).[202] I know my Aunt is just one among many—elderly people, low-income people, people with different abilities—who may be left out of online interaction, and who may be negatively affected by a trend in which many people prefer texting and chatting online to talking on the phone or in person. Media theorist and sociologist Sherry Turkle sees this trend as a fundamental danger to meaningful human interaction. In a lecture at Union College, she said, "face to face conversation is the most human and humanizing thing we can do," and expressed concerns over the ramifications of young people experiencing less face-to-face interaction, citing a study that purportedly shows a "40% decline in empathy among college students."[203] Jaron Lanier also expresses concern over the primacy of online social interaction,

[202] Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, trans. Brian Massumi (Minneapolis: University of Minnesota Press, 2003).
[203] Sherry Turkle, "Reclaiming Conversation," lecture, Union College, Schenectady, NY, February 25th 2016. (Summary from my notes, taken while attending).

arguing that due to anonymity online, the difficulty of having meaningful, dimensional debate through short-form formats such as Twitter, and the requirement to quantify oneself to participate in social networks, "the deep meaning of personhood is being reduced by illusions of bits."[204] Lanier argues that users willingly simplify themselves to make algorithms appear to work well, accepting the terms of multiple choice check boxes that could never reflect the complexity of their personalities, "Am I accusing all those hundreds of millions of users of social networking sites of reducing themselves in order to be able to use the services? Well, yes, I am."[205]

The theme in these concerns is one of reduction and erasure of personhood and social interaction, a fear that something fundamental about humanity will be lost due to our increasing adoption of technology into our every interaction—and that those who care risk being left behind. Alan Toffler gives this anxiety condition a name: "Future shock is a time phenomenon, a product of the greatly accelerated rate of change in society. It arises from the superimposition of a new culture on an old one."[206] Toffler convincingly shows how the pace of technological innovation accelerated exponentially in the current and previous century. As Toffler explains, it took 10,000 years for humans to develop past a primarily agriculture-based society to the industrial age, then only 200 years to move past the industrial age to where we are currently, a computational age which he calls "super-industrialism."[207] It's a fundamentally different experience of time than that of our ancestors, to know with some certainty that the world fifty years from now may look entirely different, in large part due to technological change. Our options are: keep up, or be old and irrelevant.

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[204] Jaron Lanier, *You are Not a Gadget: A Manifesto* (New York: Alfred A. Knopf, 2010), 17.
[205] Lanier, *You are Not a Gadget,* 39.
[206] Alvin Toffler, *Future Shock* (New York: Bantam Books, 1990), 11.
[207] Toffler, *Future Shock,* 15.

Coupled with the accelerating pace of technological change, our sense of time may be further manipulated by the technologies we use and incorporate into our bodies. Turkle asserts that, "our networked devices encourage a new notion of time because of the promise that one can layer more activities onto it."[208] Our attention is split across tasks, as well as time and space. While this division of self is sometimes welcome and gratifying, it can also feel like a cleaving of oneself, and a source of stress. It can cause one to wonder, who or what am I forgetting? Which thread did I fail to answer? Did I communicate in a meaningful way? Wearable technology has potential to become a particularly potent source of anxiety, because it is meant to be worn directly on the user. It has unprecedented access to our bodies, and potentially, to our senses of self. Referring to mobile phones and the way in which they led to a movement from a physical infrastructure, in the form of payphone networks and landlines, to a mobile, wearable network, William Mitchell posits that the concept of the Panopticon,[209] may have also morphed—from a static, architectural model of a building that provided prison wardens a clear line of sight to all of its inhabitants, to a body-based network of self-surveillance. Mitchell asserts, "I am becoming the focal point of a global personal Panopticon."[210]

Indeed, in the years since Mitchell made this assertion, numerous commercial wearables and connected devices have emerged with a primary or secondary objective of tracking users' behavior and managing that data. The iPhone collects data on users' physical activity automatically, through its native Health app,[211] as well through methods which are self-reporting,

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[208] Sherry Turkle, *Alone Together: Why We Expect More from Technology and Less From Each Other* (New York: Basic Books, 2011), 164.
[209] Michel, Foucault, *Discipline and Punish: The Birth of the Prison* (New York: Pantheon Books), 1977, et al.
[210] William J. Mitchell, *Me++: The Cyborg Self and the Networked City* (Cambridge, MA: MIT Press, 2003), 25.
[211] "Health Data," Apple, accessed March 21, 2019, https://www.apple.com/ios/health/ and https://developer.apple.com/design/human-interface-guidelines/watchos/user-interaction/accelerometer-and-gyroscope/.

such as when users, "check-in" to locations and places of commerce on applications like Facebook and Foursquare.[212] In addition to tracking physical activity, numerous fitness wearables such as the Fitbit,[213] allow users to sync information about their exercise habits with their phones and computers, and to share that information online. Wearers may also give their wearable activity trackers a license to prod them via vibration when they have been inactive for a certain period of time.[214]

A finalist in Intel's 2014 "Make it Wearable" competition would provide users a personal, gesture-activated drone,[215] with which to take photos of themselves from above. Similarly, Snap Inc., a company primarily known for its creation of the Snapchat messaging and image sharing app, has released two versions of sunglasses, called Spectacles, which allow users to record content from their daily lives, seemingly with the intention of sharing it with their social networks.[216] Other wearable cameras include GoPro[217] and MeCam,[218] both of which market themselves on portability, constancy, and the ability to take high-quality video in both high-impact situations and in daily life. SenseCam, by Microsoft Research, is a wearable camera that takes photos automatically at regular intervals, a feature described as "lifelogging."[219]

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[212] Franklin Yartley, Nii Amankwah, and Louisa Ha. "Smartphones and Self-Broadcasting among College Students in an Age of Social Media," in *Human Behavior, Psychology, and Social Interaction in the Digital Era,* ed. Anabela Mesquita and Chia-Wen Tsai (Hershey, PA: IGI Global, 2015), 95-128.
[213] Fitbit, accessed March 21, 2019, https://www.fitbit.com/home.
[214] "What is a Fitbit reminder to move?" Fitbit, accessed March 21, 2019, https://help.fitbit.com/articles/en_US/Help_article/1986.
[215] Nixie Labs Inc., accessed December 10, 2015, http://flynixie.com/. (no longer active as of March 21, 2019, but other documentation can be found at https://www.forbes.com/sites/jenniferhicks/2014/09/30/intels-make-it-wearable-contest-produces-a-flying-wearable-drone-camera/#10673d144784.)
[216] Josh Constine, "Snapchat Launches Spectacles V2, Camera Glasses You'll Actually Wear," *Techcrunch.com,* April 26, 2018, accessed March 21, 2019, https://techcrunch.com/2018/04/26/snapchat-spectacles-2/.
[217] Gopro, accessed March 21, 2019, https://gopro.com/.
[218] Mecam, accessed March 21, 2019, https://mecam.me/.
[219] Vaiva Kalnikaite, Abigail Sellen, Steve Whittaker, Dave Kirk, "Now Let Me See Where I Was: Understanding How Lifelogs Mediate Memory," *Proceedings of the SIGCHI Conference on Human Factors in Computing System,* (2010): 2045.

These examples present a snapshot of a much larger market of technologies which aim to augment users' ability to track themselves through both data and media documentation, and to share said documentation online. These features are often marketed as a way to connect with others and to get to know oneself better. As Btihaj Ajana observes in her introduction to a collected volume of philosophical thought on the topic of "self-tracking,"

> …an increasing number of people around the world are embracing this culture of quantification and self-tracking in the spirit of improving their health and charting their fitness progress. Encouraged by movements such as the Quantified Self, whose motto is 'self-knowledge through numbers', practices of self-tracking and fitness monitoring have now become routine aspects of everyday life.[220]

But while the Quantified Self movement may intend to empower users through data and self-knowledge, cultural anthropologist Natasha Dow Schüll argues that ceding so much control to wearable devices, (for example, by relying on a Fitbit to vibrate and remind you to get up and stretch), is actually a passive relationship for most users, "In fact, they (wearable tracking technologies) position users of self-tracking technology as desiring not to be in charge; the technology presents itself as a solution to this desire, offering rationality and empowerment precisely where it is lacking."[221] Schüll alludes to a larger trend in commercial wearable technology, which is a drive to self-optimize. In addition to fitness bands and health trackers, Schüll points to a wearable device which vibrates in an effort to automatically correct the wearer's posture,[222] and a smart fork which vibrates when you eat too fast, a habit the manufacturers link

[220] Btihaj Ajana, "Introduction," in *Self-Tracking : Empirical and Philosophical Investigations*, ed. Btihaj Ajana, (Cham, Switzerland: Palgrave Macmillan USA, 2017), 1. Accessed March 10, 2019. ProQuest Ebook Central.

[221] Natasha Dow Schüll, "Data for Life: Wearable Technology and the Design of Self-Care." *BioSocieties* 11, no. 3 (2016):317–33.

[222] Schüll, "Data for Life," 6. The technology referred to is called "Lumo Lift."

to, "poor digestion and poor weight control."[223] Other examples of wearable technologies which seek to actively "improve" the performance of passive users, can be found in headphones meant to optimize sleep,[224] and numerous applications for AI-driven personal assistants.[225]

The desire to cede control over both our schedules and our bodily functions to technology, seems symptomatic of the anxieties caused by our "always on," smartphone culture. The culture of multi-tasking that is promoted by connected devices, which as Turkle described, promises, "that one can layer more activities onto (time),"[226] allows users to work and socialize anywhere and everywhere, and to engage with multiple media outlets simultaneously; a practice which has been shown to increase anxiety in some users.[227] The connectedness that devices like smartphones offer, can make it more difficult to separate out time that is exclusively applied to a single task—such as time to cook or exercise. As a result, the same connected-technology that helped to produce these anxiety-ridden conditions of split-attention, is then re-packaged into various wearable inventions and apps that seek to help humans navigate their new existence within a layered timescape.[228]

In *Speed and Politics,* Virilio argues that the history of war technology is a history of mobility and speed, with warfare evolving toward a, "permanent Assault on Time."[229] He claims that when the cannon was introduced into trench warfare, soldiers that maintained their positions

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[223] Hapifork, accessed March 21, 2019, https://www.hapi.com/product/hapifork.
[224] Dan Sung, "50 wearable tech gamechangers for 2016," *Wareable,* December 14, 2015, accessed March 21, 2019, http://www.wareable.com/wareable50/best-wearable-tech.
[225] Sung, "50 wearable tech gamechangers," 45. "Amazon Echo…2016 is set to be the year of the smart virtual assistant."
[226] Turkle, *Alone Together,* 164.
[227] Mark W. Becker, et al.,, "Media Multitasking Is Associated with Symptoms of Depression and Social Anxiety," *CyberPsychology, Behavior & Social Networking* 16, no. 2 (2013): 132–135. https://doi.org/10.1089/cyber.2012.0291.
[228] Including phone apps to help users use their phones less. Jeremy Goldman, "6 Apps to Stop Your Smartphone Addiction," *Inc.com*, Oct. 21, 2015, accessed March 21, 2019, https://www.inc.com/jeremy-goldman/6-apps-to-stop-your-smartphone-addiction.html.
[229] Paul Virilio, *Speed and Politics: An Essay on Dromology,* trans. Mark Polizzotti (Los Angeles, CA: Semiotext(e), 2006), 47.

became sitting ducks; their only safety was in charging forward, to neutralize the operator of the cannon before they could launch again. "Safety is in Assault," Virilio explains, building on a quote he attributes to Colonel Delair in 1870, "The art of defense must constantly be in transformation; it is not exempt from the general law of this world: *stasis is death."*[230] It is a message that is familiar in capitalism as well, perhaps foretold by Walter Benjamin's observation of the speed with which trends in fashion change, a constant re-invention which he associated with a campaign to thwart mortality, "That is fashion. And that is why she changes so quickly; she titillates death and is already something different, something new, as he casts about to crush her."[231] The message is clear to civilians as well, charge forward into technological and cultural change. Don't get left behind.

The inventions I outlined above seek to help citizens keep up their pace, and maintain balance in a culture built on speed. But in many ways, these solutions also seek to make users more computer-like, and automated. Artist and philosopher Manuel De Landa argues that technologies are internalized into a generation's sense of self. In the late 19th century, when clocks and mechanical systems were a dominant technology, people identified with cogs and wheels, "The solar system, for instance, was pictured right up until the nineteenth century as just such a clockwork mechanism, that is, as a motorless system animated by God from outside."[232] A parallel can be found in the current prevalence of battery-powered electronics, and popular language that allows humans to identify with these devices. When we are tired, we desire to rest, "recharge" and "refuel." When we observe someone in the zone at work or at the gym, and comment with

[230] Virilio, *Speed and Politics*, 38.
[231] Walter Benjamin, *The Arcades Project,* trans. Howard Eiland and Kevin McLaughlin (Cambridge, MA: Harvard University Press, 1999), 63.
[232] Manuel De Landa, *War in The Age of Intelligent Machines*, Ed. Jonathan Crary, Sanford Kwinter and Bruce Mau (New York: Swerve Editions, 1991), 3.

admiration or resentment, "They're a machine," we mean productive, dependable, ruthlessly focused. John Henry may have died attempting to beat the machine, in the folktale about a manual laborer racing against a steam-powered hammer while building a railroad tunnel,[233] but heavy users of smartphones and connected devices no longer seek to best the machine, they seek to emulate it. Efficiency, multitasking, and speed are key features to this emulation.

5.3 Absurdity as a Counter to Anxiety

Returning to the ideas with which I opened this chapter, *The Social Escape Dress* represents a desire to escape the limits of the mortal body, to even dispense with it all together, a desire that is both mystical and commonplace. But in the strange transformation brought by the dress, which I will detail further in the design section that follows, we can also find a possible answer to some of the polemic aspects of wearable technology which I have earlier outlined: an absurdist response, aimed at disrupting the cycle of anxiety associated with wearable technology. Norman Klein writes that special effects and thrill-seeking attractions like roller coasters offer, "reenactment of the anxieties of urban life," and "simulated death."[234] The solution then, to the fear that our bodies will be left behind and disappear in face of technological change, is to simulate it, by disappearing. It is a logic indebted to the absurdist methodology.

[233] Christopher Allen Varlack, "John Henry," in *American Myths, Legends, and Tall Tales: An Encyclopedia of American Folklore,* ed. Christopher R. Fee, Jeffrey Webb, and Danielle R. Dattolo (Santa Barbara, CA: ABC-CLIO, 2016), 533–535. By some accounts, John Henry did defeat the hammer, but died in the process.
[234] Norman M. Klein, *The Vatican to Vegas: A History of Special Effects* (New York: The New Press, 2004), 203.

Rowan Atkinson, in his mockumentary on physical comedy observed, "the things we laugh at are closely related to the things that frighten us,"[235] adding that there is a pleasurable liberation in humor and comedy, which offers, "a license to fish out strange images from the depths of our unconscious." Atkinson is a particularly relevant reference for considering absurdity in relation to wearable electronics, because he is an expert in slapstick, a form of comedy that is all about using the body as a tool. The idea of seeking a reprieve from anxiety or sadness through humorous and absurd uses of the human body, is one which has also persists in 20th and 21st century performance art practice. For example, Bas Jan Ader, who made videos of himself falling off of things, such as the roof of his house in, *Fall 1, Los Angeles* (1970). Jörg Heiser draws a parallel between Ader and Charlie Chaplin,[236] a reference which implicitly links Ader back to Dada, whose members were admirers of Chaplin's slapstick parodies of industrial progress.[237] Abigail Susik cites Chaplin's 1916 film *Pawnshop* as a likely influence on Dadaist Francis Picabia, specifically a scene in which Chaplin,

> …attempts to repair a customer's alarm clock by dramatically prying it open like a tin can and then tearing out its contents, all the while squirting black oil over its parts…In a final gesture that suggests the best way to fix an annoying alarm clock is simply to destroy it altogether, Chaplin puts the oily parts back into the customer's hat, and then knocks him unconscious with a hammer strike to the head.[238]

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[235] "Part 3," *Funny Business,* created by Rowan Atkinson, Robin Driscoll and David Hinton, performance by Rowan Atkinson, season 1, episode 3, Tiger Television Productions, 1992.
[236] Jörg Heiser, "Curb Your Romanticism: Bas Jan Ader's Slapstick," in *The Artist's Joke,* ed. Jennifer Higgie (London and Cambridge, MA: Whitechapel Gallery and MIT Press, 2007), 85–89.
[237] Jed Rasula, *Destruction Was My Beatrice: Dada and the Unmaking of the Twentieth Century* (New York: Basic Books, 2016), 15. As Rasula notes, "lists of Dada presidents were regularly published: everyone who was known to have participated in any Dada activity was listed as president—with a few thrown in for good measure, like Charlie Chaplin."
[238] Susik, "Chance and Automatism," 394.

The alarm clock in this example serves as a clear metaphor for humanity's relationship between time, work, and stress. Where commercial wearable technology seeks to incorporate time and speed into humanity's sense of self, first through the analog wristwatch and now through more complicated means,[239] Chaplin's solution is to smash it over our heads, using the body as tool in time's destruction. The usefulness of this approach is explained by Surrealist writer André Breton's observation that gallows humor, or humor rooted in destruction or fear, can be a way to emotionally remove oneself in difficult situations, a method to, "displace the psychic accent away from the ego and onto the *superego*."[240] Similar psychoanalysis is offered by Sigmund Freud, who in 1905 theorized that nonsense may be pleasurable because it relates, "to the mind's unconscious reaction against the compulsion of logic and reality."[241] Humor, shock, strangeness, thrill, disruption—these are all potential reprieves from the daily cycle of anxiety in which many of us exist, a condition that has undoubtedly been enabled by technology, and with it, a constant threat of job loss, environmental destruction and cultural change.

5.4 Case Study: *Urban Armor #7: The Social Escape Dress*

The Social Escape Dress produces a cloud of fog based on how much stress the wearer is feeling. In contrast to commercial wearable technologies which seek to reduce stress by making individuals more efficient, *The Social Escape Dress* seeks to dramatically visualize this feeling of

[239] Susan Elizabeth Ryan, *Garments of Paradise: Wearable Discourse in the Digital Age* (Cambridge, MA: MIT Press, 2014), 35.

[240] André Breton, "Lightning Rod," in *The Artist's Joke,* ed. Jennifer Higgie (London and Cambridge, MA: Whitechapel Gallery and MIT Press, 2007), 46.

[241] Sigmund Freud, "Jokes and Their Relation to the Unconscious, 1905," in *The Artist's Joke*, 25-30.

anxiety, while also obfuscating the wearer's body, allowing her to temporarily disappear. It is a response that acknowledges the absurdity of attempting to find a mechanical solution to a systemic, societal problem, as well as an acknowledgment of the optimistic and dream-like potential of transformation through dress and technology.

5.4.1 Iterations and Design

Before arriving at the design for a dress, I had considered making a Social Escape Handbag. For this iteration, I thought the simplest way to produce fog would be by heating fog juice in a vessel on a hot plate. I purchased a small, round hat box, which I planned to serve as the structure of the handbag, with the round hot plate fitted into the base. Challenges with this design idea were caused by the fact that I needed to trigger the fog through electronic means, and I needed to power the mechanism through batteries. Most hot plates operate on wall power, which in the US provides 120V, and is not something I can realistically obtain from a small battery. 120 volts is also more voltage than I want to put on a human body, because it can be dangerous. As a work around, I purchased several hotplates intended to be used with a computer's USB port, most of them billed as coffee cup warmers, and which operate on only 5 volts, but they were unable to produce enough heat to vaporize liquid into fog. I ran into similar power issues with ultrasonic transducers, which produce fog through rapid vibration, but which also generally run on wall power. I considered other ways of producing heat, such as by mechanically rigging a lighter beneath the vessel containing the fog liquid, but this seemed unnecessarily dangerous. Another flaw to the early hat box design was that it required a heating element to sit beneath an open container of fog juice, which could easily spill. I thought designing a container based on something like a percolator

might help with this, but it was a moot point, because I could not produce enough heat to bring the liquid to a boil (Fig 5.1).

I next scoured the internet for other methods for producing fog through battery-powered heat sources, and I found a tutorial for how to modify a vaporizer, or "e-cigarette," to create a significant amount of fog, relative to the components' size.[242] This example used the metal and glass body of the vaporizer, which includes both an area to hold liquid and a heating element which screws directly onto its base. Normally, a battery would then be attached directly to the heating element at the vaporizer's base, which is threaded, and a user would hold the battery and inhale from the glass end of the vaporizer as the e-cigarette liquid was heated and vaporized. However, as I came to discover through my online research, there is a fairly vibrant community of e-cigarette users who modify their vaporizers by attaching bigger batteries, to provide better heat and longer usage. This can be a dangerous endeavor, because heating elements draw power at a high rate, and when using rechargeable lithium-ion batteries, a high rate of discharge, such as that which would be caused by a short circuit, can lead to combustion and fire.[243] Consequently, there are many discussion forums (and cautionary tales) online regarding the best approach to modifying power

[242] Chimpusmaximus, "DIY Smoke Machine from Ecig Clearomiser," accessed March 25, 2019, https://www.instructables.com/id/DIY-Smoke-Machine-from-Ecig-clearomiser/.
[243] Diego Lisbona and Timothy Snee, "A Review of Hazards Associated with Primary Lithium and Lithium-Ion Batteries," *Process Safety and Environmental Protection* 89 (2011): 434–442.
A high-profile example of a short-circuit leading to an explosion in a Li-ion battery was Samsung's Galaxy Note 7 J. J. Yun, et al.,, "Benefits and Costs of Closed Innovation Strategy: Analysis of Samsung's Galaxy Note 7 Explosion and Withdrawal Scandal," *Journal of Open Innovation: Technology, Market, and Complexity* 4, no. 3 (2018), https://doi.org/10.3390/joitmc4030020.

Figure 5.1: Early design concept for Social Escape Dress, which I thought could include a hot plate and a percolator in a hand bag. Kathleen McDermott, 2015, Adobe Illustrator.

supplies for vaporizers. The example I earlier cited, used a threaded metal part called a "battery mod connector,"[244] that screws into the base of the vaporizer's heating element, where the battery would normally directly connect. Insulated wire is then soldered to the mod part and extended out to a power supply (a bench power supply in the case of the tutorial). Again, the vaporizer tank design normally requires direct contact between the vaporizer and the battery, but soldering long wires to the mod element allows the user to reach a power supply that is physically disparate. This was useful for my purposes, because I sought to power multiple vaporizers from one battery source, and because I wanted to distribute the weight of the batteries around the body, away from the vaporizers themselves. Another innovation in Chimpusmaximus's tutorial, was their use of an aquarium pump motor to pump air through the base of vaporizer, in order to force the fog up and out of the top of the vaporizer tank. In normal usage, a person would place their mouth on the top of the vaporizer and inhale, drawing the vapor out of the unit. The pump motors solve this problem by pushing the fog out automatically.

After testing one module according to Chimpusmaximus's method, and finding success, I sought to make multiple units that could be sewn into a dress, to increase the total amount of fog produced. In an effort to reduce the total amount of batteries, I sought to power multiple units from distributed li-ion batteries, which required soldering long wires to the battery mod connectors on the vaporizers. The primary challenge in this process was in achieving a good connection between the mod parts and the external wires, particularly to a small internal ground piece, which is

[244] "Unsealed Ego Battery Connector," Stealthvape, accessed March 26, 2019, https://www.stealthvape.co.uk/electronic-cigarette-mod-parts/ecig-mod-parts-battery-connectors/unsealed-ego-battery-connector.

separated from the power piece by a rubber gasket, and which is easily damaged. More details on this process can be found in the tutorial linked at the end of this chapter.

Ultimately, I created nine mobile foggers from modified e-cigarette cartridges, which were then filled with a solution of glycerol and distilled water, a recipe for DIY fog juice I found online.[245] Glycerol is a common ingredient in moisturizers, derived from plants and algae,[246] which is gentle on human skin, and can be purchased at drug stores in the form of glycerin, a first-aid agent. Each of the nine modules required an aquarium pump motor to push the fog through the vaporizers. These motors were divided into groups of three and each group was powered by a pack of 4 AA batteries, which provides 6V. The heating elements of the foggers needed to be powered separately. These were also divided into groups of three, which could each be controlled a 3.7V, 6600maH rechargeable lithium-ion battery.[247] As I mentioned above, it is important to use a battery with an appropriate current rating for a heating coil, and I found 6600maH to be within the safe range for powering three of these units. Due to the high current draw, it is was ideal to use a rechargeable source. However, these rechargeable batteries also added a significant cost to the overall design, retailing at $29.50 each.[248]

I then laid out six relay circuits on blank printed circuit boards (PCBs), which I used to control the six groupings of batteries automatically, through an Arduino Nano. This is a key part

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[245] Eric Derr and Timothy Dahl, "How to Make a DIY Fog Machine for a Spooky Halloween," *Popular Mechanics,* October 10, 2017, accessed March 26, 2019, https://www.popularmechanics.com/home/interior-projects/how-to/a9573/build-a-diy-fog-machine-for-a-spooky-halloween-16024637/.

[246] Christiane Goedl, et. all, "High-Yielding Biocatalytic Process for the Production of 2-O-(α-D-Glucopyranosyl)-Sn-Glycerol, a Natural Osmolyte and Useful Moisturizing Ingredient," *Angewandte Chemie*, no. 52 (2008).

[247] Due to shipping restrictions on these batteries, I was only able to obtain one, and so also purchased 3 slightly smaller Li-ions, (3.7V, 4400maH) and powered the foggers in one group of 3, and 3 groups of 2. However, the design for using 3 larger batteries would have been tidier and could still be implemented.

[248] "Li-ion Battery," Adafruit, accessed March 26, 2019, https://www.adafruit.com/product/353.

of the design and the absurdist method, because it allows the fog machines to be turned on automatically, and introduces the possibility of chance. A galvanic skin response (GSR) sensor was also connected to the Arduino, which was used to measure the wearer's stress, and to trigger the relays. A GSR sensor can be used to identify sudden changes in the conductivity of the wearer's skin, which may indicate a heightened state of stimulation:

> GSR is a momentary decrease in the apparent electrical resistance of the skin resulting from activity of the sweat gland in response to mental or emotional stimulation…(the meter) picks up the fluctuations in conductance caused by the person's overall general mood and emotional reactions to specific stimulus. These changes in conductance (due to the moisture level of the skin) are known as the Galvanic Skin Response (GSR).[249]

GSR sensors are sometimes used in combination with a blood pressure machine and heart rate monitor in lie detector tests.[250] Because I am using a low-cost sensor, as opposed to a medical-grade device, and because formal GSR studies are normally conducted under controlled conditions where other factors can also be monitored, within *The Social Escape Dress,* the GSR sensor can only be considered an approximate measure of stress. In fact, I find the idea of self-monitoring stress-levels through skin conductance to be somewhat ridiculous, because wearing such a device is and of itself a stressful practice. The connection between GSR sensors and lie detectors is also interesting to me, because an early model of a lie detector machine was created in the early 1920's by William Moulton Marston, who would later create the comic book character Wonder Woman.[251] According to Jill Lepore, William Marston was partially inspired by woman's suffrage

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[249] Anurag Joshi, et al.,. "An Experimental Analysis to Monitor and Manage Stress among Engineering Students Using Galvanic Skin Response Meter." *Work* 56, no. 3 (2017): 409–420, https://doi.org/10.3233/WOR-172507.

[250] Mahima Sharma, Sudhanshu Kacker, and Mohit Sharma, "A Brief Introduction and Review on Galvanic Skin Response," *International Journal of Medical Research Professionals* 2 (2016): 13-17.

[251] Jill Lepore, *The Secret History of Wonder Woman* (New York: Alfred A. Knopf, 2014), 35.

when he created Wonder Woman; almost every story by Marston includes a moment in which Wonder Woman has to literally break free from chains, a reference to suffragist imagery.[252] Furthermore, Wonder Woman's origin story is rooted in Greek Mythology, a culture that also influenced the Surrealists, for its threads of magic and the occult. This commonality points to the fact that comic books, (and their tangential relationship to pop science) are an apt reference for considering the relationship between wearable technology and transformation, magic powers that are analyzed by Margaret Atwood as relating to, "overcoming the restrictions of the body, that dead weight of ultimate mortality we lug around with us."[253]

In addition to the GSR sensor, I added a push button, in case I wanted to trigger the fog manually for testing. Because I wanted to distribute the foggers around the body fairly evenly, and each relay circuit would need to be connected to a group of foggers, I used separate PCBs for each relay circuit and connected them to each other and to the Arduino via long wires and quick-release screw terminals. I sewed the PCBs to a strip of fabric, that acted like a belt, and could be worn around the waist. The goal was to keep the circuit boards stationary and close to the foggers they were controlling, to reduce any physical strain on the wires.

Another design challenge came in distributing the weight of the batteries and obscuring the electronics within the garment, so that the fog could appear to simply emerge from the dress. To do this, I made a smock and sewed pockets to it, to hold the batteries evenly around the body. The smock opened in the back with Velcro. I then opened and laid the smock on a flat surface, and

[252] Lepore, *The Secret History of Wonder Woman*, 46. However, Lepore adds that the chains were likely sexually stimulating to Marston, and describes his interest in feminism as "fetish," making Wonder Woman and Marston complicated figures to analyze.

[253] Margaret Atwood, *In Other Worlds: SF and the Human Imagination* (New York: Anchor Books, 2011), 32.

distributed the foggers across it, marking where each would be placed. I sewed tight loops of elastic at the top of the smock to hold the foggers, and at the waist to hold the motors. The elastic holds the electronics in place but still allows them to be removed, in case an element needs to be switched out. Four groupings of foggers and motors are distributed across the front of the smock, and five line the back. At this point, it was helpful to put the smock on a mannequin, to refine the layout of the elements around the body. I then added the PCB belt, described above, and connected the foggers and motors to the control circuits via the quick release terminals.

Through-out this phase, I also experimented with fabric and other materials for constructing the dress, particularly the collar, to observe how it affected the appearance of the fog, and to make decisions about where the fog modules should sit on the body. In one experiment, I used several strips of fabric window blinds to hang like pleats over the smock. In this design, the fog emerged from between the pleats of the blinds and was dispersed around the body. The way each strand of fog was separated by the blinds, made it appear more like smoke than fog (Fig 5.2). At this stage it became clear that I had to visually distinguish between smoke (from fire), and fog (an atmospheric effect). Where smoke may imply fire and danger, fog gives the impression of transformation, obscurity, and transcendence. Aside from how the fog is allowed to escape from the dress, the other major factor which can contribute to the reading of fog vs. smoke is lighting, which I will explain further in the documentation section.

Figure 5.2. Allowing the fog to escape at many points around the dress caused it to separate, and appear more like smoke. The image also shows how I used a breadboard and alligator clips for testing, before soldering everything to a PCB. Kathleen McDermott, 2016.

In order to collect the fog into a larger mass, I decided to gather the tops of all the foggers near the collar of the dress (fig. 5.3). I had debated for a period of time whether I wanted the

garment to look innocuous, i.e., like everyday street wear, to increase the feeling of surprise when the fog emerged, or whether I wanted the garment to look more fantastical. I decided that creating a garment that looked more futuristic, or high-fashion would help with the reading of the dress as being transcendent, and I sought a material that would have a high-tech, high-performance feel. Ultimately, I found a quilted, black imitation leather, which I turned inside out to reveal a more silvery-grey lining. While I like the texture of this material, it turned out to be difficult to work with and easily revealed sewing mistakes. I wanted something stiff, to help hold the shape of the collar, but the stiffness also meant the dress didn't flow away from the waist, which would have been helpful for obscuring the bulky electronics sewn into the smock under the dress.

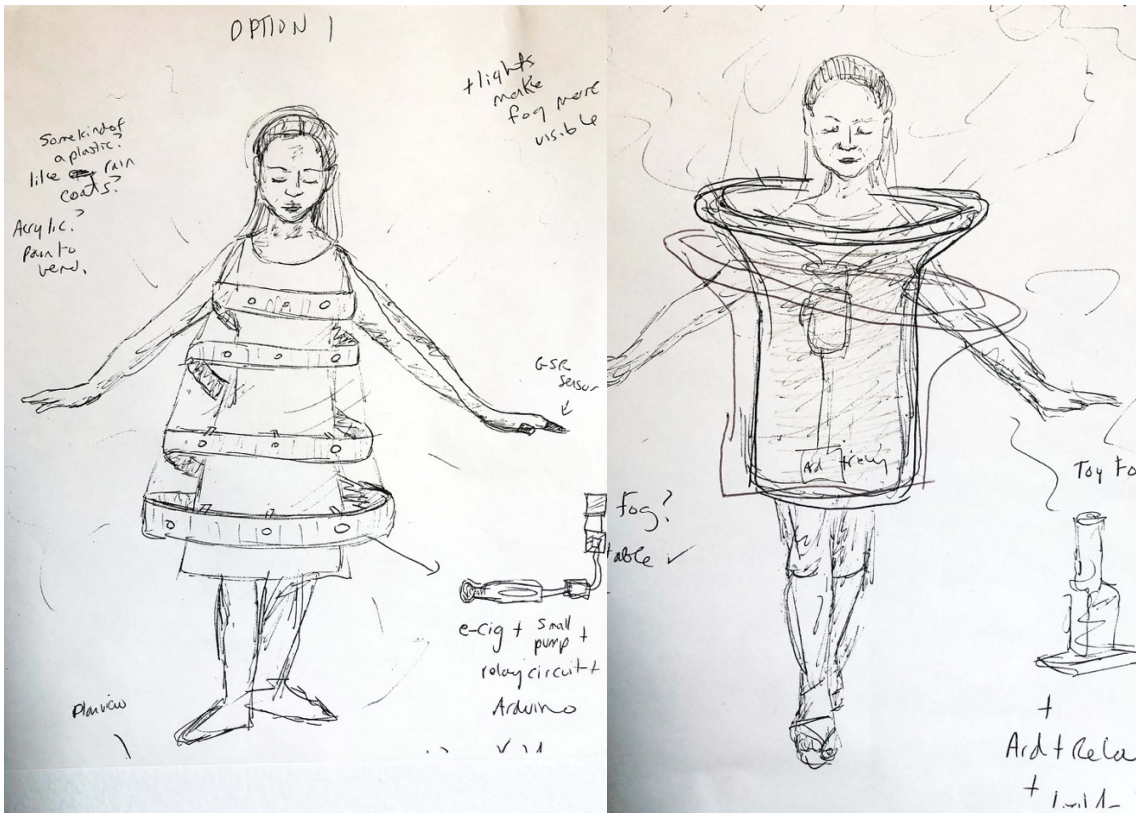

Figure 5.3: Design sketches, Kathleen McDermott, 2016.

Another design challenge lay in making sure I could access the electronics easily, and that the garment could be slipped on and off without disturbing the wiring. At this phase I consulted with a seamstress and costume designer, Annie Bruce, and we decided the best course of action would be to make a high-waisted skirt, and a separate top. The skirt would be tightest at the model's natural waist, (just under the line of the bust), and the radius of the skirt would expand out from that point, allowing the electronics to fit underneath. To produce the structured top, Annie first experimented with modifying a lamp shade, which worked quite well, but only with a light-weight polyester fabric we were using to test. We ultimately used a heavy (18 gauge) wire to create a radius to sew the top to, and hold the tubular shape. Additional support wires slipped into support pockets sewn into the smock, to help the top stay upright, and not to pitch forward. The wires from the galvanized skin response sensor ran up the body and through the arm hole, where they travelled down to the model's finger, to obtain a stress measurement (Fig 5.4 and Fig 5.5).

Figure 5.4: ***The Social Escape Dress*** **in its final version, still from video. Kathleen McDermott, 2016.**

Figure 5.5: ***The Social Escape Dress*****, still from video. Kathleen McDermott, 2016.**

5.4.2 Documentation, Reception and Conclusions

The process of documenting The Social Escape Dress was difficult for a number of reasons, but chief among them was the fact that it was difficult to predict when the fog would be deployed. Because I had anticipated the dress being somewhat difficult to document, I had employed a number of friends to help film. We gathered in my apartment in downtown Troy, to debrief and to ensure that the dress was in working order before trying to film it outside. We decided to get one shot inside the apartment, but when we set-out to do so, the dress immediately began releasing fog, perhaps because the atmosphere as we were preparing to film was becoming stressful for the

model, Trona Cenac. This was a problem, because we were trying to obtain establishing shots of the dress without the fog, and to capture the moment of release for maximum contrast. However, the dress frequently began releasing fog before our shots were set-up. (This was ultimately pretty funny, as we were continually thwarted by the machine). After many attempts at this, my smoke detectors began to go off. Smoke detectors had not been an issue while making the dress in my studio, because it has heat-activated sprinklers, rather than smoke detectors. We moved the filming venture outside, and after gaining a fair amount of footage in a spontaneous way, I unplugged the sensor and asked Trona to simply control the dress with the push button, so that we could get the critical shot of the dress right before it was activated. We filmed for many hours around downtown Troy and had a number of unscripted interactions, including a moment where a bright red pick-up truck came to a halt directly in front of Trona, who began to emit fog, and the driver turned to stare at her as his brakes softly squeaked. I caught this moment on camera, and it is framed quite nicely. However, I struggled with whether to use this or other footage with bystanders in it because I did not have a clear narrative in my mind for the video, and many of the shots with bystanders in them felt like they could detract from the more surreal effect I hoped to achieve with the dress. We also had some less ambiguous interactions while filming, such as with a young man on a hover board who rolled into our shot unexpectedly, causing Trona to laugh. After talking, we asked him to enter the shot again and to have Trona activate the dress in response, which worked well, but in the end, the fog did not look great in the shot we captured. This ended up being the case in a lot of the footage; depending on the angle of the light, the wind, and whether the model was in motion, the fog sometimes looked greyer and more smoke-like, which was something I really wanted to avoid. For this reason, as well as my uncertainty about using images with other bystanders in it, I ultimately used just one moment from the footage, which was luckily caught from two angles,

where the wind and light conditions were favorable, and the fog looked quite billowy and full. There is no narrative to this video, but I think that is ok, as the image is strange enough to imply a larger story. I digitally removed cars from the road and a few pedestrians in the distance on the sidewalk. I also masked out the fog and keyed it bluer in After Effects, to further increase the surreal effect. I later added blue lights to the rim of the dress, to help control the fog aesthetic, and did some filming experiments with blue spot lights in my basement (Fig. 5.6), but ultimately, I prefer the shots of the dress in the city, as I think they are stranger and harder to categorize than the indoor shots, which would more quickly be recognized as constructed/contrived.

Figure 5.6: Still from controlled shoot with blue light, Kathleen McDermott, 2017.

Overall, it was interesting that a garment meant to visualize stress, became stressful to document. The oddity of the visual created by the dress, led to many people wanting to talk to us while we were attempting to film outside. This was not terrible, but also not ideal, because although I am very interested in the conversations that emerge in these moments, it is difficult to focus on the shoot while also engaging with the public simultaneously. And while having a team of people with cameras present may offer some assurances to bystanders that what they are witnessing is a creative endeavor, the fog-emitting dress is extremely unusual and prompted many questions. I attempted to be as measured and dialogical as possible when engaging onlookers, but it was a pretty exhausting process for everyone involved. I was extremely grateful for the assistance of my fellow crew members, and especially for that of Trona, the model, who was fantastic.

Because performing these wearable electronics outside can be an unusual experience, I am frequently conflicted about whether I should have someone else wear them, or whether it should only be me. However, I like the idea that documenting other women wearing my garments may allow more people to be visualized within the strange, parallel realities I seek to construct. I do not want the absurdist wearables to be only an elaborate form of self-portraiture, I want to imply the possibility that their transformative properties can be embodied by others. In this sense, I am more so utilizing the strategy of critical design, when I remove myself from the scene and document the objects in a way that doesn't preclude the possibility that they could be designed products, demonstrated by paid models. Practically speaking, I also like being on the other side of the camera, so that I can frame and control the shot, which is ultimately the primary artistic output of the production. Still, while the practice of working with models to document objects is par-for-the-course in design, it is more loaded when considering the work as art. Ultimately, I will continue to handle the question of whether I should be the person wearing the creations on a case by case

basis, but a big factor is whether I plan to use the language of design, or to be more overtly artistic in the documentation style.

For example, a piece I completed in 2017, *Memorial for Bad Jokes,* was a more deliberate exploration of a surreal documentation style and self-portraiture, for which I put a camera on a tripod and filmed myself wearing four different wearable electronic pieces. One of these was *The Social Escape Dress*. The others included *The Public Speaker*, a shawl covered in speakers through which I played a recording of myself screaming, *Little Drummer Boy*, a robotic strap-on which I used as a drum stick, and *I Thought it Would be Funny*, a garment which spelled out its titular phrase in blinking LED lights. I designed *I Thought it Would Be Funny* to be a death shroud, because I thought it would present an interesting phrase to find on my body at the time of my death, and the other wearables in *Memorial for Bad Jokes* were meant to be members of my funeral procession. I filmed myself wearing each one separately as I entered the scene from the left of the frame, performed, and then exited to the right. I then masked out the four characters and composited them together in After Effects, creating a potentially endless loop of characters entering and exiting (Fig. 5.7). Again, while my tendency to shift between the language of art and design is sometimes a source of confusion, it is also evidence of the way in which I actively explore meaning through absurdist electronics. It is often difficult to determine the visual impact of a particular object, until I see it moving/working/emitting. I enjoy approaching the documentation of these objects as an experimental process, and I am extremely grateful to all of the people who have participated in this process with me.

Figure 5.7: Kathleen McDermott, *Memorial for Bad Jokes,* 2017. (Video still).

5.4.3 Video Links

The Social Escape Dress: https://vimeo.com/326661696/3abd8f2a72.

Memorial for Bad Jokes: https://vimeo.com/195685514/eb5e25ea95.

5.4.4 *Tutorial*

https://urbanarmor.org/portfolio/the-social-escape-dress/ (Fig. 5.8).

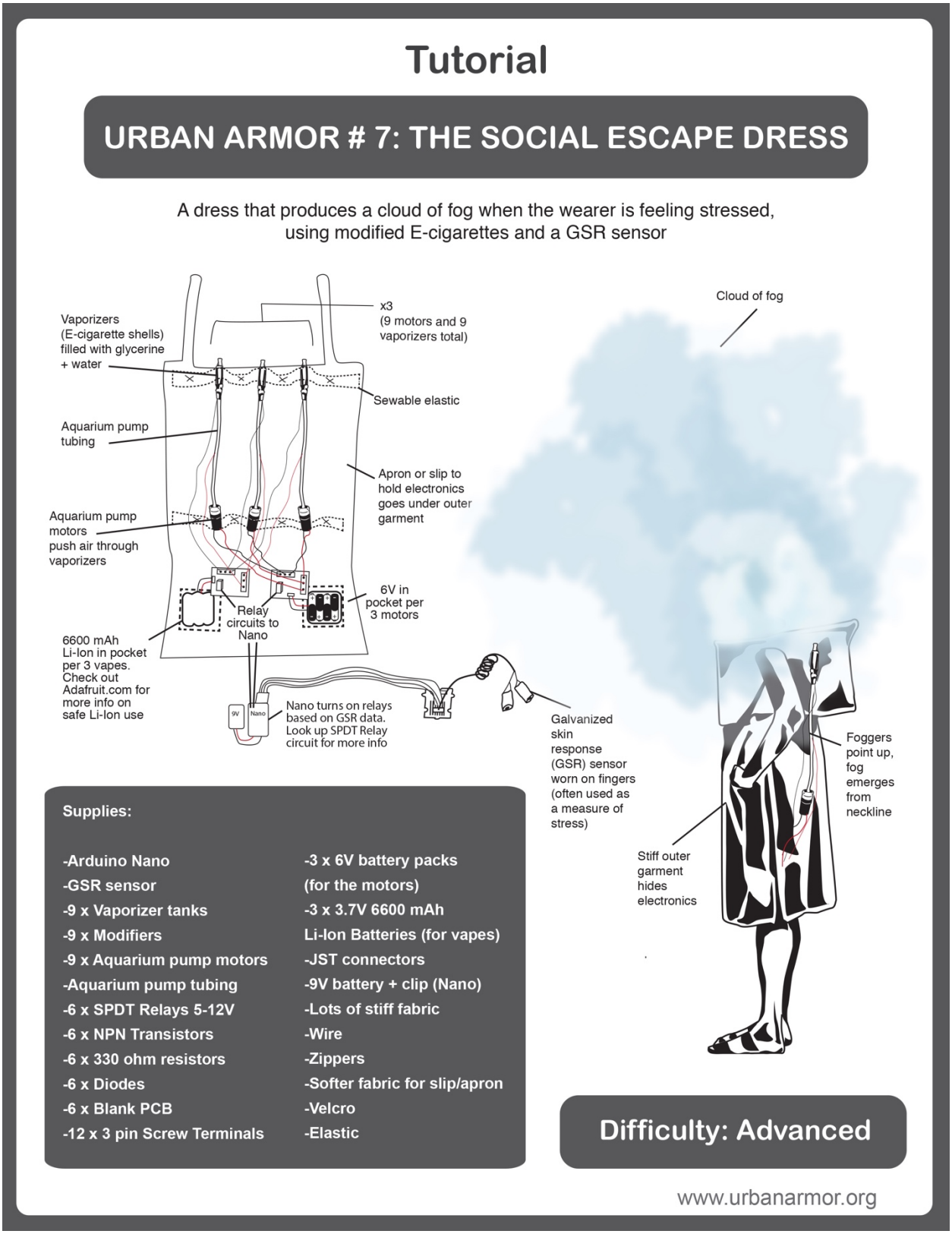

Figure 5.8: ***The Social Escape Dress*** **graphic tutorial, Kathleen McDermott, 2018.**

6. ANXIETY, EFFICIENCY, AND AN ABSURDIST RESPONSE, PART 2—URBAN ARMOR #10: THE POWER SUIT

6.1 "Power Dressing" and Commodified Empowerment

Where *The Social Escape Dress* seeks to simulate disappearance, and deals with transformation and abstraction, *The Power Suit* aims to more directly engage with slapstick, flailing its arms wildly in response to anxiety-inducing environments; a movement that can be considered playful, hysterical or assertive. Where *The Social Escape Dress* is more fantastic, *The Power Suit* aims to reference everyday life, and specifically, work. The suit consists of a blazer in which the fabric arms have been replaced by long, plastic tubes that inflate automatically in response to loud sounds. Extra fabric panels have been added to the back of the suit jacket to create a cape-like shape, which allows the wearer to hide her real arms under the garment.

The garment consists of an ivory-colored pantsuit, a reference to the cliché image of the ambitious working woman's "power suit," such as that worn by Melanie Griffith in the 1988 film *Working Girl*.[254] Regarding the evolution of the power suit, Joanne Entwistle makes a parallel between the emergence of tailored fashion in the Victorian age, which was indicative of "newly expanding opportunities for women to appear in public," and a period in the late 1970s and early 1980s, when "the growth of professional and businesswomen in relatively male-dominated occupations and spheres of work required a new way of dressing for increasing visibility at work *as* professionals. This resulted in the adaptation of the male business suit, known as the 'power

[254] Mike Nichols, director, *Working Girl*, performance by Melanie Griffith, (USA: 20th Century Fox, 1988).

suit.'"[255] The power suit trend later abetted, in part because with more women in the workplace, it no longer seemed necessary for women to invoke a historically male uniform, in order to be recognized as professionals. However, the concept of "power dressing," or "dressing for success," has endured in popular culture, as evidenced by countless contemporary articles on the topic.[256] Entwistle attributes the origin of the term "power dress," to a manual by John T. Molloy, published in 1980 titled, *Women: Dress for Success*, in which Molloy claims, "most women dress for failure," and encourages women to approach clothing management like a science, for engineering success. Entwistle explains, "(Molloy) helped introduce and establish the 'power dressing' phenomenon of the 1980s, defining a style of female professional garb which has now become something of a sartorial cliché; tailored skirt suit with shoulder pads…"[257] The power suit has been experiencing a revival in the last few years, however, and has been re-examined in pop-culture think pieces through lenses that note the contribution of the power suit to conversations on gender nonconformity.[258]

In addition to referencing the idea of women dressing for success, the use of white in *Urban Armor #10: The Power Suit* references early 20th Century suffragette protestors, who used costume, dress and theater as part of their demonstrations, and often wore white. Jill Lepore

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[255] Joanne Entwistle, "The Dressed Body," in *Real Bodies,* ed. Mary Evans and Ellie Lee (London: Palgrave, 2002), 142.

[256] A few examples:

NJ Goldston, "Five Power Dressing Tips to 'Boss Up' Your Wardrobe and Empower You in The Workplace," *Forbes*, May 23, 2018, accessed April 4, 2019, https://www.forbes.com/sites/njgoldston/2018/05/23/five-power-dressing-tips-to-boss-up-your-wardrobe-and-empower-you-in-the-workplace/#203556e0320a.
Serena Hood, "The New Power Dressing: How to Dress for Work Now," *Tatler*, July 16, 2018, accessed April 4, 2019, https://www.tatler.com/article/the-new-power-dressing.

[257] Joanne Entwistle, "'Power Dressing,' and the Construction of the Career Woman," in *Fashion Theory: A Reader,* ed. Malcom Barnard (London: Taylor and Francis, 2007), 208.

[258] Angella D'Avignon, "The Power Suit's Subversive Legacy," *The Atlantic*, December 26, 2017, accessed April 4, 2019, https://www.theatlantic.com/technology/archive/2017/12/the-power-suits-subversive-legacy/549200/.

describes scenes in which women dressed to represent the states of the union in the U.S., with demonstrators wearing chains to represent states that had not granted women the right to vote. Other protests consisted of silent vigils outside the White House, with participants holding signs that read, "How long must women wait for liberty?" allegedly the last words of suffrage-activist, Inez Milholland.[259] According to Jennifer L. Borda, British suffragists were the first to consider color and branding for the women's movement. They chose several signature colors, among them white, which represented purity—an appeal to moderate women that was meant to show that they could advocate for their rights without being considered radical.[260] According to Einav Rabinovitch-Fox, the decision of suffragists to embrace style and fashion was tactically important to the movement's broader popularity, "Feminists' success in popularizing their reformative ideas regarding women's clothing lay in their ability to forge a positive link between mainstream fashion and feminism."[261] But the use of white was also a media-conscious decision; in black and white newspaper images of suffragette parades, large groups of women wearing white created a sharp contrast between bystanders, primarily men in dark suits.[262]

Perhaps because of this lineage, women wearing white suits have had some iconic moments recently, in political theater. Hillary Clinton wore a white suit in the third 2016 presidential debate with Donald Trump, and white suits were worn by women in Congress, to Trump's state of the union speech in 2019,[263] with newly elected congresswoman Alexandria Ocasio-Cortez's white

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[259] Jill Lepore, *The Secret History of Wonder Woman* (New York: Alfred A. Knopf, 2014), 46–48.
[260] Jennifer Borda, "The Woman Suffrage Parades of 1910–1913: Possibilities and Limitations of an Early Feminist Rhetorical Strategy," *Western Journal of Communication* 66, no. 1 (2002): 25–52.
[261] Einav Rabinovitch-Fox, "[Re]Fashioning the New Woman: Women's Dress, the Oriental Style, and the Construction of American Feminist Imagery in the 1910s," *Journal of Women's History* 27, no. 2 (2015): 14–36.

[262] Rabinovitch-Fox, "How White Became the Color of Suffrage," *The Conversation*, February 15, 2019, accessed April 4, 2019, http://theconversation.com/how-white-became-the-color-of-suffrage-111576.
[263] Emily Crockett, "House Democratic Women are Wearing White–a Symbol of Women's Suffrage–to Trump's Speech," *Vox*, February 28, 2019, accessed April 4, 2019, https://www.vox.com/identities/2017/2/28/14748562/trump-congress-women-house-wear-white-suffragists.

cape-suit gaining particular notice.[264] Although the political events of 2019 occurred after I created *The Power Suit,* the choices made by these politicians and the immediate media analysis after the fact, demonstrates how the white pantsuit remains accessible in American collective memory as a historical reference to women's empowerment. Playing on these references, and on the cliché idea of a woman needing to assert herself in a loud, male-dominated environment, such as in the Wall Street bullpen, the arms of the *The Power Suit* inflate in respond to loud sounds. This gesture is inspired by "wacky inflatable tube men," or "air dancers;" giant nylon tubes with arms, that are often outside car washes or strip malls, to gain the attention of drivers. The air dancers move erratically, due to their long dimensions and the fact that air is being piped through them, creating "centrifugal effects," which destabilize them.[265] They on the one hand could be considered hysterical, as they fling themselves from side to side, sometimes bending over so far as to touch the ground with their heads; however, the fact that they generally feature a simple smiley face printed near their top, seems to indicate that they are not hysterical, but simply enthusiastic. I thought that introducing a similar degree of enthusiasm, intensity and unpredictability to a human's arm movement, could be both an assertive and absurdist response in a figurative work environment. The absurdity of the garment acknowledges the contradictions present in the links between gender equality movements, and fashion and mass-media, as these tools serve to increase visibility, but also commodify and standardize the idea of the empowered woman.[266]

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[264]Kerry Pieri, "Alexandria Ocasio-Cortez's Perfect White Cape Blazer, We Salute You," *Harpers Bazaar,* February 6, 2019, accessed April 4, 2019, https://www.harpersbazaar.com/fashion/trends/a26193461/alexandria-ocasio-cortez-cape-blazer/.

[265] Anne Cross, J.A.R. Romero, F.C. Flores, "Sky Dancer: A Complex Fluid-Structure Interaction," in *Experimental and Theoretical Advances in Fluid Dynamic*s, ed. Jamie Klapp, et. al (New York: Springer, 2012), 21.

[266] As I've earlier stated in the Research Methods Chapter, these qualities reference Dada. "The Dadaist loves the extraordinary, the absurd, even. He knows that life asserts itself in contradictions..." Hugo Ball, "Dada Fragments,"

6.2 Iterations and Design

In a similar design challenge as that presented by *The Social Escape Dress,* the *Power Suit* required that I produce a small, battery-powered version of a technology that is normally wall-powered. The air dancers which this project references, are normally inflated by massive pump motors. In my testing, I utilized a recycled pump from an air mattress, which is small relative to the size of commercial air dancers, but still much too large to be fitted into a garment. My early research led me to the material rip-stop nylon, which is light-weight, durable, can be sewn on a sewing machine, and is often used in kites. My first instinct was to try pulsing my pump motor on and off to attempt to achieve the dancing effect, because I'd assumed it was caused by changes in the rate of air flow. However, this failed and I was forced to do more research, where-in I found that the dancing effect is not caused by variation in the motor speed, but rather by the relationship between the speed of air flow and the dimensions of the tube, which should be long, thin and open at the top. As the motor provides a steady rate of air flow, the air escapes through the top of the tube and creates a fluid-dynamic interaction. As Cross, Romero and Flores explain, "Air flow which passes through the tube deforms the tube wall which in turn modifies the flow hydrodynamical properties."[267] The researchers in this study had a variable motor supply, and so could experiment with different rates of air flow relative to their tubes. Because I had a motor that could only supply one speed of air flow, I instead experimented with tube materials, seeking the right weight and dimensions to produce the centrifugal effects.

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in *The Artist's Joke,* ed. Jennifer Higgie (London and Cambridge, MA: Whitechapel Gallery and MIT Press, 2007), 31.

[267] Cross, Romero and Flores, "Sky Dancer," 15.

After several iterations with rip-stop nylon and the air mattress motor, I was able to make a working air-dancer, but I then needed to produce a mobile version, which required creating a smaller air blower. I first attempted to do this from scratch, finding examples online of "mini-leaf blowers," and using PVC pipe, plastic food cartons and cardboard to make a small, handheld blower (fig 6.1). This design worked well enough, however, the intake area for the air was at the side of the blower structure, and quite large. As I considered how I could fit such a structure into a garment, I was concerned the vent would be pressed against fabric and unable to intake enough air to function well.

Figure 6.1: Homemade mobile air blower with intake vent at the side. Kathleen McDermott, 2017.

I then found a tutorial by Dina Amin[268] an artist based in Egypt, who shows how to make a mini air-dancer using a hairdryer.[269] The hairdryer is better suited to being fitted into a garment than the leaf-blower, because its air intake vents are at the bottom, rather than the sides. Amin demonstrates how to take apart a hairdryer, access the motor at the back, and remove the diodes at its base which convert the power input from AC (alternating current) to DC (direct current). These diodes are in place so that the hairdryers can be powered through wall power, which uses alternating current. In addition to needing a steady supply of power for the motors, wall power is ideal for the heating coils in hairdryers, which draw power at a high rate. But because no heat is needed in this application, it is possible to remove the heating coil and the diodes from the back of the motor, making the dryer compatible with battery-power and turning it into a reliable, mobile air blower. I purchased hairdryers second-hand for this, at Goodwill, where I also purchased the air mattress pump, and which has since led me to think more about how to incorporate recycled consumer electronics into other applications, something I have also begun to explore in workshops.

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[268] I interviewed Amin over Skype (IRB 1668: Absurdist Electronics Dissertation: Image Requests and Interviews), because I was interested in her thoughts on the absurdist electronics methodology, and I also wanted to learn why she so generously creates tutorials. I learned, through our conversation that she does not necessarily identify as an artist, and that her work defies categorization. She uses electronics, stop motion and graphic design among other media, but the main theme that emerged was experimentation. She mentioned that she likes to learn new things, she likes to make people smile, and she likes to make functional things. She also mentioned that she likes to share information online, because she learned a lot through online tutorials herself, and wanted to give back. She mentioned that particularly for girls in Egypt, it is encouraging to see women share information online. I found a lot of synchronicities between Amin's practice and my own, particularly in her motivation for sharing tutorials online, but our conversation helped me realize that it would not necessarily be useful for her to consider her work within a specific methodology, as she is often freelancing and making content for advertising, which is different from producing in an art/academic context. My interview with Amin was meant to be the first in a series, which would be added to the Absurdist Electronics manual, but I realized it would make more sense to put up a call for submissions to such a publication, and to allow people to elect to join the project, rather than for me to try to select people, as an outside observer. So, this is something I may consider doing, as a postdoctoral project.

[269] Dina A. Amin, "How I Made a Mini Wacky Waving Inflatable Arm Flailing TUBE MAN," youtube.com, August 3, 2017, accessed April 4, 2019, https://www.youtube.com/watch?v=hxn57e8N3xA.

Amin was building a table-mounted air blower and so built a wooden structure around her hairdryer to keep it in position. For my application, within a garment, I had to devise a way to keep the hairdryers positioned securely upright, as well as discreetly under the garment. I decided the best way to position them was with the handle under the armpit, and the mouth of the hairdryer directly in front of the shoulder. I used a light linen fabric to sew a simple tank top, which opens in the front. I cut the clasp mechanism from an old bra and sewed it into the front of the tank top, so the fit could be adjusted on the model. I sewed two pieces of elastic into an X formation on either side of the tank top, to make a cradle to hold the base of the hairdryer, which is the heaviest point. I then used an additional elastic loop to secure the top part of the dryer against the side of the garment, to prevent it from falling over. I also sewed a loop over the handle, to keep it secure under the armpit (fig 6.2).

Figure 6.2: Hair dryer pinned in place with elastic, which I later sewed to the undergarment. Kathleen McDermott, 2018.

I had earlier soldered long extension wires to the motors of the two hairdryers, and threaded those though the handles, where the power cord would normally exit, before reassembling the plastic housing of the units. I connected the wires of both hairdryers to a 12V battery pack, for testing. The next challenge was to find a material that was suitable for making inflatable arms tubes that would work with these much smaller air blowers. I tested the nylon that I'd used in earlier experiments with the air mattress pump, and immediately found it was too heavy. I then searched for more references on homemade inflatable structures, and found that a commonly used material is disposable plastic table cloths, which can be fused together, (because they are too delicate to sew) using an iron. The system I devised, was to cut a long strip of table cloth, set down some fabric beneath it, and set a 2x4 piece of wood on top of it. Then I folded the plastic table cloth over the top of the wood, to make a tube, and laid more fabric on top of it. The fabric was to protect the iron from fusing with the plastic. The difficulty with this method, is that too-little heat will not fuse the plastic at all, but too-much will very quickly rip holes through it, making it unusable. I made probably a dozen arms from table cloth, which were hard to compare, in terms of performance, because many had holes. It was difficult to determine if an arm functioned better than others because the dimensions were exactly correct, in terms of width to height ratio, or if it simply had less holes than the others. Frustrated, I went to a corner store to buy more table cloth, but they didn't have any, and so I bought white garbage bags instead. Luckily, the garbage bags turned out to be heartier than the table cloth I'd had, and it was easier to fuse the tubes without creating a hole. Eventually, I arrived at a height/width ratio that worked well. I wanted the arms to be as long as possible, to maximize the ridiculousness of the effect, but there was a critical point at which they would be too long and heavy to rise. Making them thinner could help with this problem, but it was also not desirable to make them thinner than the mouth of the hairdryer. I

attempted to build out a cap for the hairdryer out of cardboard, to narrow the opening before attaching it to the narrower arms, but I found this extra attachment allowed more air to escape from the sides. So, the best solution was to make the arms the same radius as the hairdryers, and to fit them over the mouth of the dryers directly, sealing them with rubber bands and tape. The height limit was determined based on this width. Once I had a a good working arm, I made multiples, because I was worried the garbage bag arms would easily tear, though they actually turned out to be pretty durable.

After I'd created working inflatable arms and attached them to the hairdryers that were mounted into the undershirt, I needed to adjust the suit shirt and jacket to fit over them and cover the electronics. For the suit shirt, I simply purchased a white collared shirt second-hand, cut the arms off of it, and enlarged the arm holes, to allow the hairdryers to fit through them and sit outside the shirt. This was necessary so that the driers would have more air exposure. Tailoring the suit jacket was more difficult, because the existing arm holes were arranged at the sides of the shoulders, with seams, but the hairdryers were positioned more-so in front of the shoulders. It was necessary to cut the arms off the jacket entirely, split the jacket at its seams, and pin in more fabric panels, to modify the overall shape of the garment. The jacket had been boxy and tapered, and I altered it into something more cape-like, which expanded as it approached the waist, to make space for the wearer to hide their arms (Fig 6.3). The wide, open base of the garment was also useful for allowing air to flow freely into the hairdryer vents. I added additional fabric to build out new arm holes which the hairdryers fit into, and threaded the plastic tubes through the holes.

Figure 6.3: Images of the suit jacket modification in progress: adding fabric panels to change the shape and building out new arm holes. Kathleen McDermott, 2018.

The design worked really well on the mannequin, which was where I was building out the structure and conducting tests. When I shifted the whole garment onto the body of my model, Martha O'Connell, I found her shoulders were narrower than the mannequin's and the undershirt was somewhat lose, which allowed the hairdryers to sag. This was easily rectified by taking in the undershirt and adjusting the clasp, but this caused the hairdryers to pull in closer together than the armholes that I'd built into the suit jacket. The change was very slight and I could still shift the suit to fit over the hairdryers properly, but it created some problems while we were filming, because the hairdryers sometimes shifted out of the armholes, reducing the performance of the inflatable tubes. In hindsight, it would have been preferable to have waited to sew the suit armholes until after measuring the model.

Once I had a wearable version of the inflatable tubes that worked whenever I turned the hairdryers on, I then laid out and soldered a transistor circuit, to allow me to turn the power supply on and off through an Arduino. I also connected a sound sensor, which I threaded underneath the

front of the suit, inside the lining of the breast pocket. I cut a small hole to allow the microphone to stick outside the fabric. I sewed pockets into the back of the undershirt, which opens in the front, leaving a large area across the back where I could fit electronics. I used screw terminals on the circuit board, to allow me to easily disconnect the hairdryers and battery, which is useful when helping the model put the garment on. I made no changes to the matching suit pants.

6.3 Documentation and Reception: Wall Street

As I earlier mentioned, the *Power Suit* was meant to interact with the most iconic fixture of male white-collar work, Wall Street. As is often the case with documenting my electronic creations, I wanted to see how it would perform in the outside world, and what moments would emerge naturally in this process (fig 6.4 and 6.5). I also had several storyboarded shots I wanted to try, such as establishing shots, that showed the model walking out of the subway station. We filmed for an afternoon and captured some interesting moments, including Martha watching a revolutionary war-reenactment drum brigade. She also walked by a group of construction workers, who had been observing us from afar, and one of them waved his arms wildly in greeting/response, which he then gamely repeated, so we could get the shot from another angle. We struggled to film her in front of the Wall Street Raging Bull, because of the crush of tourists. The other shot we failed to achieve, which I'd hoped for, was to see her arms rising while among a sea of men in dark suits. To get this shot, we probably would have needed to film much earlier in the morning, to catch a critical mass of people arriving to work before the trading floor opened. However, as I mentioned in regard to *The Social Escape Dress,* it can be nerve-wracking to film these wearable electronics outside and I was especially nervous to film near Wall Street, because I assumed the

police presence in the area would be vigilantly looking for signs of danger, and a large amount of electronics strapped across a woman's body could easily be construed as threatening. So, we decided to film in the afternoon on a week day, to have a little more space from crowds.

Overall, the filming operation went smoothly. Most people were busy moving through the city and paid little attention to us, with the exception of some tourists who took pictures and a few who engaged with us. Aside from the documentation occurring in a different context, New York City being a place where citizens are more accustomed to seeing odd street performance and art, I think the garment was more obviously humorous than the *Social Escape Dress* and so it raised fewer questions. However, since we played it safe with the documentation, I was left feeling unsure about the end result of the video. I think it reads as silly, but it doesn't necessarily read as related to the workplace, because it is shot entirely on the street, and its lightness made me wonder if it was absurd enough. Therefore, I decided to document it again, this time in front of a green screen.

Figure 6.4: *The Power Suit*, still from documentation video near Wall Street. Kathleen McDermott, 2018.

Figure 6.5: *The Power Suit*, documentation photo near Wall Street. Photo credit: Blake Johnson, 2018.

6.4 Documentation: Green Screen

Documenting the *Power Suit* in front of the green screen was productive because the controlled environment allowed the women who wore the suit to be more experimental and playful, than in the high-pressure environment of filming on the street. I conducted the green screen experiment with three of my PhD colleagues, Senem Pirler, Angela Beallor and Michelle Temple. They each took turns wearing the suit, and operating the camera, which was great, because they had an opportunity to see how the suit appeared on each other, as well as within the camera viewfinder. They experimented with moving in ways that accentuated the motion of their inflatable arms, walking, spinning, dancing, and swaying, and at certain times embodying the feeling of the wacky inflatable tube person within their entire gesture.

I had found some stock footage of the Wall Street trading floor, as well as clips from movies such as *Wolf of Wall Street* and asked them to act as though they were in the scenes (fig 6.6). I also had clips from You Tube proposal videos, a whole genre of compilation videos, in which one half of a couple surprises the other with a marriage proposal in a dramatic location, The Eiffel Tower being a particularly popular spot. I like these videos because they are both sweet and absurd. The decision on the part of the person proposing, to meticulously plan and film their process with the intention of putting it online for potentially millions of people to see, makes me wonder about changing expectations of gestures of love, visibility and performance. Inevitability, the videos are overlain with pop songs, implying that the couple resides full-time within the high emotional decimal of a music video. I wonder what happens when the camera turns off and what they talk about on the plane ride home. Is there an electric charge that dissipates when they are no longer filming? In what ways are these public displays, which overwhelmingly feature straight couples, a perpetuation of the myth that heteronormative relationships are the ultimate romantic ideal? I

thought inserting *The Power Suit* into these scenes could provide some comic relief, as well offer the kind of enthusiasm the couples are likely seeking in an audience. Lastly, I've been experimenting with putting *The Power Suit* into vacation videos and You Tube video logs, including some that feature inflatable tube men (fig 6.7). The green screen footage I currently have needs to be refined and masked out more carefully, as the long flailing arms often exceeded the height of the screen and failed to key out properly. The angles of the shots also need to be more carefully considered, to match the footage I seek to insert *The Power Suit* into. While I am still unsure of what the right constructed environment for *The Power Suit* may be, these early tests have helped me consider new possibilities for constructing strange environments, beyond filming on the street, and to approach the documentation process as a place for creative iteration.

Figure 6.6: *The Power Suit*, still from documentation test with Angela Beallor, Senem Pirler, Michelle Temple and Kathleen McDermott, 2018–2019.

Figure 6.7: *The Power Suit*, still from documentation test with Angela Beallor, Senem Pirler, Michelle Temple and Kathleen McDermott, 2018–2019.

6.5 Video Link

https://vimeo.com/268821353

6.6 Tutorial

https://urbanarmor.org/portfolio/the-power-suit/ (Fig 6.8).

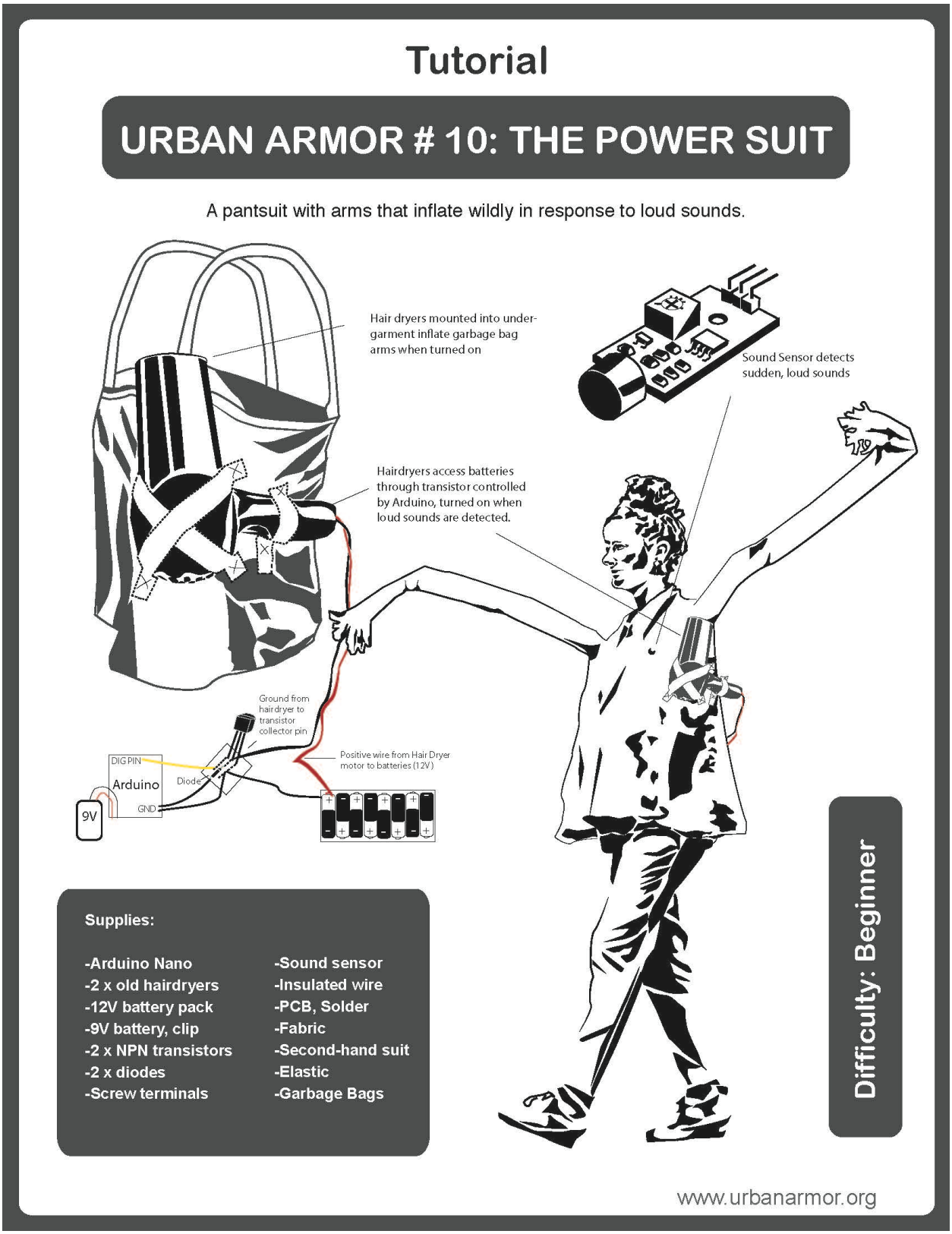

Figure 6.8: ***Power Suit Tutorial,*** **Kathleen McDermott, 2019.**

7. WEARABLES FOR NON-HUMANS—SUNBOT AND SUNBOT SWARM

7.1 Background

The preceding chapters have focused on the ways in which wearable technology may affect the human body and its relationship to desire, anxiety, and work, which are all fundamentally human constructions. In what way does creating wearable technology for non-humans allow different kinds of philosophical and design questions to emerge? As Haraway has observed, the hybrid-nature of the cyborg has the potential to flatten distinctions and blur boundaries between species.[270] However, cyborgs and wearable technology are also constructions that have emerged out of humanity's constructions of science, technology, and research, and it is difficult, as a designer, to escape this human-centered framing.

Sunbot (fig 7.1), a very simple robot that takes a houseplant into the sun, begins to explore the implications of attempting to create wearables for non-humans. *Sunbot* uses photocells, or light-sensitive resistors, to detect ambient light levels and control the movement of two wheels, which are attached to the grill of an old electric fan. A houseplant, (a Boston Fern in the first iteration), sits on top of the fan grill, which is serving as the robot chassis. If a low-level of light is detected, the wheels will turn on and the plant will move forward until enough light is detected, at which point the plant will stop. The sensors are controlling each wheel separately, which allows for some variety in the plant's movement. For example, if the sensor on the right side of the plant receives enough light, the right wheel will stop; but if the left sensor is not receiving enough light,

[270] Haraway, "Apes in Eden, Apes in Space: Mothering as a Scientist for National Geographic," in Haraway, *Primate Visions,* 138.

the left wheel will continue to move forward, causing the plant to turn, until both sensors receive enough light. This simple responsiveness and ability to self-adjust, when tested with a plant in an outdoor area, yielded surprisingly interesting results and raised a number of questions regarding agency from the perspectives of both philosophy and robotic design.

Figure 7.1: *Sunbot Version 1,* Kathleen McDermott, 2016.

Video link: https://vimeo.com/178359991

7.1.1 The Cartesian Split in Robotics Design

The first version of the *Sunbot* was inspired by Valentino Braitenberg's *Vehicles*, a theoretical work which uses premises of photocell-based robots as a lens through which to discuss the structure of the human brain. One of Braitenberg's assertions is that, "analysis is more difficult than invention,"[271] and that humans tend to ascribe more complexity to both synthetic and organic systems, than may actually be warranted. In Braitenberg's analogy, a robot programmed to stop in areas of sunlight may be described by a human observer as having an affinity for sunlight, or as "liking it," an analogy which would greatly overstate the intelligence of the system. (Although Braitenberg draws the analogy in relation to a robot with an affinity for the color red).

I documented the *Sunbot* roaming around a small town in Maine, primarily leaving my camera on a tripod so that I could serve as the robot handler, and pull it out of the road in the case of traffic. There were many occasions where the robot struggled; it did not do well with potholes or curbs between the sidewalk and road, which often caused it to get stuck and/or tip over. But there were also many moments when it worked well. I repeatedly carried it into shady areas, and then placed it on the ground. It would then move forward out of the shade, sometimes turning in the process, until the sensors levelled out, which gave an appearance of sophisticated self-adjustment. By cutting together moments in which the robot functioned well, the resulting video gives an impression of a robot/plant that is much more intelligent than it is. When showing the video to the general public, a common analysis is, "It is looking for light." However, that is not exactly true. The robot is moving forward indiscriminately (it does not even have obstacle-avoidance capability), and is simply stopping when it senses enough light. The common assumption that the robot is proactively *looking for light*, appears to anecdotally corroborate

[271] Valentino Braitenberg, *Vehicles: Experiments in Synthetic Psychology* (Cambridge, MA: MIT Press, 2000), 20.

Braitenberg's assertion that humans tend to assume designed systems are more complex than they are.

Unbeknownst to me at the time of making the first *Sunbot,* was the fact that I was loosely mimicking an early robotic design by William Grey Walter.[272] Walter's "tortoises," Elmer and Elsie have been described by Owen Holland as, "the first biologically inspired robots."[273] According to Holland, Grey Walter built the robots in 1949, primarily in his home, with help from his wife Vivian Walter, (who coauthored eight papers with him). Grey Walter's tortoise design utilized a single photoelectric sensor, or light sensor, which was attached to a shaft in the front of the robot that was also attached to a driving wheel. "The…(photoelectric) cell is aligned with the driving wheel so that the direction in which light is sensed is always the direction toward which the driving wheel is moving."[274] The motorized front wheel allows the photocell to constantly scan the area in which the robot is driving toward, for light. If enough of a light response is detected, "this introduces behaviour pattern P, the positive phototropic or light-seeking response,"[275] which essentially disengages the motor that is causing the front wheel to constantly turn and scan, and causes the robot to move toward the direction where the light-response was detected.

New Yorker writer Larissa MacFarquhar has noted, in a profile of the philosopher Andy Clark, that, "although (the tortoise robots) were mechanically simple, they were surprisingly unpredictable. Because the world that Walter put them in was complicated, their behavior was complicated. They seemed like animals."[276] If Elmer and Elsie were humans, they would be

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[272] W. Grey Walter, "An Imitation of Life," *Scientific American,* (1950): 42–45.

[273] Owen Holland, "The First Biologically Inspired Robots," *Robotica* 21 (2003): 351–363.
[274] Holland, "The First Biologically Inspired Robots," 354.

[275] Ibid, 356.
[276] Larissa MacFarquhar, "The Mind Expanding Ideas of Andy Clark," *New Yorker,* March 26, 2018, accessed May 1, 2019, https://www.newyorker.com/magazine/2018/04/02/the-mind-expanding-ideas-of-andy-clark.

navigating the world solely based-on information gained through sensations such as touch or smell, as opposed to operating based on high-level decision-making or logic. This model of robotic design stands in contrast to later experiments, such as Stanford Research Institute's 1965 robot, "Shakey."[277] Shakey, who according to Peter Hart was conceived primarily by Charles Rosen, was a tall, vertical robot whose upright dimensions were more similar to a human. Shakey was equipped with a camera, a camera control unit, and on-board logic, and it had much higher-level processing abilities than Elmer and Elsie. Before Shakey's wheels allowed it to move in any direction, it utilized its camera to analyze its surroundings, and made decisions based on its ability to process that data. Feigenbaum describes Shakey as a grandfather of the self-driving car.[278] However, according to MacFarquhar, Shakey moved very differently than Elmer and Elise. It required a lot of time to process data before it made movements, and anecdotal observations of Shakey indicate that it was slow and seemed inorganic, despite the fact that it was technically more sophisticated.[279]

The difference between Elmer, Elsie, and Shakey, is not merely one related to technical complexity. It is also related to the Cartesian mind/body split, René Descartes's 17th Century theory which put forward the idea that the mind could be separated from the body, and which subsequently had wide-ranging philosophical and scientific implications.[280] The Cartesian split has since been widely criticized for proliferating the idea that humans can use the power of their minds (generally in applied forms of math and science), to control their bodies and surroundings. Wander Eikelboom explains, "Sensitivity to the embodied human experience was lost during the

[277] Benjamin Kuipers, Edward A. Feigenbaum, Peter E. Hart, Nils J. Nilsson, "Shakey: From Conception to History," *AI Magazine* 38, no. 1 (2017): 88-103.
[278] Feigenbaum, "Shakey," 90.
[279] MacFarquhar, "The Mind Expanding Ideas of Andy Clark."
[280] Marleen Rozemond, *Descartes's Dualism* (Cambridge, MA: Harvard University Press, 2002).

Enlightenment. Descartes separated body and mind and in this act created the modern human subject that can perceive, know and rule the world by the power of the ratio."[281] Judith Butler critiqued the pervasiveness of Cartesian dualism, as perpetuating hierarchies that are reproduced in gender norms, "The mind not only subjugates the body, but occasionally entertains a fantasy of fleeing its embodiment altogether. The cultural associations of mind with masculinity and body with femininity are well documented within the field of philosophy and feminism."[282] The Cartesian mind/body split can be considered a precursor to the idea that a human may upload their brain to a computer and remain fundamentally unchanged, an idea which is integral to contemporary debate on posthumanism. As Ellie Brians explains, theorists such as Hans Moravec, whose work implies, "the body is obsolete and must be transcended," have been countered by Katherine Hayles and others who, "argue instead for a posthumanism that explores and pushes the boundary of our relationship to technology, without ever forgetting or effacing the body."[283]

The tortoise robots and Shakey can be considered examples of robots modelled on embodied knowledge (approximated through sensors), and cognitive knowledge, respectively. Designing and programming robots in some ways reflects the ways in which we think humans work—or should work. In contemporary robotic design, MacFarquhar explains, most robots are based on a combination of the cognitive and embodied models. This compromise can be considered parallel to Clark's general stance on the posthuman debate, he argues that our brains, "were designed by nature to be unusually open to profound reconfiguration by the specific and

[281] Wander Eikelboom, "Ethereal Scent," in *Posthuman Glossary*, ed. Rosi Braidotti and Maria Hlavajova (London: Bloomsbury Publishing, 2018), 139.
[282] Judith Butler, *Gender Trouble: Feminism and The Subversion of Identity* (New York: Routledge, 1990), 12.

[283] Ella Brians, "The 'Virtual' Body and the Strange Persistence of the Flesh: Deleuze, Cyberspace, and the Posthuman," in *Deleuze and the Body*, ed. Laura Guillaume and Joe Hughes (Edinburgh: Edinburgh University Press, 2011), 128–129.

technologically evolving environments in which they grow and learn."[284] Clark implies that humans brains are powerful, but this power is derived in part through our bodies' ability to embody tools which help us cull knowledge and engage with our surroundings.

7.1.2 Plants as Emblematic of an Embodied System

While the Cartesian mind/body split is an obvious framework for considering the difference between the tortoise robots and Shakey, this metaphor is structured around human bodies. The tortoise robots in particular have been described as the first "biologically-inspired" robots, with Grey Walter hoping to emulate qualities in animals such as,

> …exploration, curiosity, free-will in the sense of unpredictability, goal seeking, self-regulation, avoidance of dilemmas, foresight, memory, learning, forgetting, association of ideas, form recognition, and the elements of social accommodation.[285]

In his papers, Grey Walter frequently makes a parallel between the photoelectric sensor on the tortoise robots, and an "eye," turning to scan the environment, in a way that is similar to a tortoise moving its head.

Considering other possible models for robotic design, plants are an excellent example of systems which have a degree of complexity, but no known central processing system. Anyone with houseplants may observe the way in which plants grow naturally toward light, sometimes twisting and leaning in the process, showing a kind of awareness of where the light is and how to reach it. Plants also have methods for keeping time, and have, "evolved sophisticated mechanisms for

[284] Andy Clark, *Natural-Born Cyborgs* (New York: Oxford University Press, 2003), 141.
[285] W. Grey Walter, *The Living Brain* (New York: Norton, 1953).

anticipating predictable environmental changes that arise due to the rotation of the Earth on its axis. These mechanisms are collectively termed the circadian clock."[286] Importantly, plants' circadian clocks are decentralized,[287] presenting a very different model of culling information from the world, than the centralized human brain. Although their processing systems appear to be decentralized, researchers and artists have shown that plants have communication systems akin to synapses.[288] The artist Miya Masaoka reads the electrical pulses from plants as part of a performance practice[289], and plant behavior researcher Monica Gagliano even contends that plants such as *mimosa pudica* can exhibit learning behavior.[290]

In what ways can wearable or robotic systems be designed to benefit the unique intelligence-systems of plants? Some examples can be found in several interdisciplinary art projects, each of which has a different conceptual framing. Katherine Behar's *High Hopes (Deux)* (2015), features a pair of rubber trees each sitting on top of a Roomba automatic vacuum, roaming around an artificial field in a gallery while instrumental music plays. Behar's playful investigation relates to her philosophical engagement with the field of object-oriented ontology. According to Behar, the installation, "aims to upset distinctions between natural and artificial, biological and machinic, behind-the-scenes service work and performative display, and to prompt solidarities

[286] Michael J. Gardner, et al., "How Plants Tell the Time," *Biochemical Journal* 397, no. 1 (2006): 15-24.
[287] Hanako Shimizu, et al., "Decentralized Circadian Clocks Process Thermal and Photoperiodic Cues in Specific Tissues," *NATURE PLANTS* 4, no. 12, (2015): 1126. https://doi.org/10.1038/s41477-018-0327-2.

[288] Zhong-Yi Wang, et al., "Monitoring Systems for Electrical Signals in Plants in the Greenhouse and its Applications," *Biosystems Engineering* 103, no. 1 (2009): 1-11.

[289] Miya Masaoka, *O, Plant!* (2018), http://miyamasaoka.com/installations-performances/2018/o-plant-2/.
[290] Monica Gagliano, et al., "Plants Learn and Remember: Let's Get Used to It," *Oecologia* 186, no. 1 (2018): 29–31. https:// doi.org/10.1007/s00442-017-4029-7.

across these categories."[291] In Behar's piece, the Roombas and their relationship to domestic labor are equally important actors as the plants, which appear to be elegantly along for the ride.

GARRy (2015), a project by Byron Rich and Heather Brand, uses a small, GPS-enabled robotic chassis to carry ragweed, an invasive species, toward the direction of its place of origin, or "ancestral land." Byron writes, "The work problematizes what it means to relocate an entity back to its home, for on the journey it interacts with local ecosystems that may or may not be already affected by its presence," and draws a parallel to human histories of colonization.[292]

IndaPlant Project: *An Act of Trans-Species Giving*, by Elizabeth Demaray in collaboration with Dr. Qingze Zou and other researchers at Rutgers University, "is designed to facilitate the free movement and metabolic function of ordinary houseplants."[293] *IndaPlant* led Demaray and Zou to coin the term "floraborg," to describe an, "entity that is part plant and part robot." *Indaplant* is similar to *GARRy* and *Sunbot,* in that consists of a small wheeled robot, adapted to suit a plant. In addition to allowing the plants to seek the sun, *Indaplant* also plants to drive themselves to a water dispenser when their soil is dry.

7.1.3 Climate Change, Anxiety, and Absurdity

[291] Katherine Behar, "High Hopes (Deux) Statement," accessed May 1, 2019, http://www.katherinebehar.com/art/high-hopes-deux/index.html.

[292] Byron Rich and Heather Brand, *GARRy* (2015–17), accessed May 1, 2019, http://byronrich.com/G-A-R-R-y-Work-in-Progress-2015-2017.

[293] Elizabeth Demaray, "FloraBorg Community Update: 3 IndaPlants Up and Running," July 23, 2014, accessed May 1, 2019, https://elizabethdemaray.org/2014/07/31/floraborg-community-update-3-indaplants-up-and-running/.

As I've become more acquainted with the crowded field of plant-related robotics and examined my own motivations for making *Sunbot*, my original curiosity at visualizing a behavioral phenomenon explained by Braitenberg, has shifted into a larger interest in plant migration and independence. The element of the *Sunbot* video which is most successful and interesting to audiences, (as I have concluded from anecdotal feedback), is the absurd implication that the plant has become migratory, or is a tourist. This concept can be related back to Hayles's assertion in *How We Became Posthuman*, that, "The sense that the world is rapidly becoming uninhabitable by human beings is part of the impetus toward the displacement of presence by pattern."[294] In other words, the threat of climate change and the anxiety this may cause, may make people more interested in retreating to virtual/digital reality. But if humans plan to escape to a digital world, where does that leave plants and animals? This question alludes to the body of thought around the Anthropocene, a term for a new epoch in the history of Earth, marked by mankind's alterations to the Earth's climate.[295] According to Jeremy Davies, "The idea of the Anthropocene epoch lets us understand the ecological crisis of the present day in the context of the distant past."[296]

Returning to the lens of absurdist electronics, there are many indications that this method could be suitable for destabilizing humans from the center of a robotic investigation. Dada and Surrealist artists were constantly engaging in meaningful investigations with objects. By presenting Readymades, byproducts of industrial production practices, in galleries as art objects, Dada artists destabilized the idea of the human artist as a sole author of an artwork.[297] David

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[294] N. Katherine Hayles, *How We Became Posthuman* (Chicago, IL: The University of Chicago Press 1999), 37.

[295] Sverre Raffnsøe, *Philosophy of the Anthropocene: The Human Turn* (Cham, Switzerland: Palgrave Macmillan Limited, 2016), Accessed, April 1, 2019, ProQuest Ebook Central.

[296] Jeremy Davies, *The Birth of the Anthropocene* (Oakland, CA: University of California Press, 2016), 2.

[297] Lewis Hyde, *Trickster Makes This World: Mischief, Myth and Art* (New York: Farrar, Straus, and Giroux, 2010), 123-124.

Hopkins describes Duchamp's Readymades as, "part of an ongoing enquiry; a series of experimental propositions as to what art might look like freed from the artists' touch…"[298] Hannah Höch's collage work similarly challenged the hierarchy of relationships between human bodies and objects, leading Matthew Biro to explore her work through the lens of the term "cyborg," despite the fact that her work predated the emergence of term. As Biro explains,

> In addition to representations of human–machine hybrids, Höch's photomontages include syntheses between humans and animals, between people of different genders, between persons of different ethnicities and cultures, and between individuals of different ages or generations.[299]

Although these precedents are primarily object and people-oriented, one can infer that a similarly absurdist approach to designing with plants and animals could be effective in raising questions regarding hierarchies of value in contemporary wearable design. Furthermore, I have earlier framed absurdist electronics as a strategy for negating some of the anxiety inherent to wearable technology and its dystopic possibilities (chapter 4). The absurdist electronics method may be similarly useful for allowing productive or unusual dialogue to emerge around the anxiety-ridden space of the Anthropocene.

7.2 Sunbot Swarm

[298] David Hopkins, "New York Dada: From End to Beginning," in *A Companion to Dada and Surrealism*, ed. David Hopkins (Hoboken, NJ: Wiley Blackwell, 2016), 150.
[299] Matthew Biro, *The Dada Cyborg: Visions of the New Human in Weimar Berlin* (Minneapolis: University of Minnesota Press, 2009), 202.

As I can began to consider the communicative power of the plant-based robot more carefully, I realized that the visual narrative I hoped to communicate, was one of robotically-enabled mass-plant migration in the face of climate change. To do this effectively, I felt I needed to create multiples of the *Sunbot,* which led me to the *Sunbot Swarm,* an idea for creating a mass of mobile plants with low-level communication abilities.

7.2.1 First Iteration

Entering into the territory of making multiples, I wanted to develop a system to make reproduction of the robots easier. I also wanted to improve the overall performance of the robots. Rather than controlling each DC wheel motor through a transistor circuit, as I had done in the first version, which allowed me to simply turn the wheels on and off, I laid out a motor control circuit, which allowed me to turn the wheels on and off, as well as backward and forward. Writing the wheels to move backward is useful for helping the robot back away and turn to avoid obstacles. Further, I added an ultrasonic sensor to help the robot detect obstacles in front of it, as well as an infrared emitter and receiver, a low-cost technology that is used in remote controls, to allow the robots to communicate. In terms of introducing communication, I had struggled with what kind of system to develop. "Swarm robotics," is itself a field built on emulating self-organization of insects[300] but swarm behavior is not necessarily something we see exhibited by plants. I also considered a system using Wi-Fi, to enable more complex communication to occur, as well as a system for reading the electromagnetic impulses of the plants, similar to that used by Miya

[300] Vito Trianni, *Evolutionary Swarm Robotics : Evolving Self-Organising Behaviours in Groups of Autonomous Robots*, ed. Janusz Kacprzyk (Berlin: Springer Berlin Heidelberg, 2008), 3.

Masaoka. However, in the interest of completing a working version in a timely manner, I ultimately decided to utilize infrared, a method I'd seen[301] utilized in a low-cost swarm robotic experiment completed by researchers at Harvard.[302] In the future, I plan to keep exploring other systems for allowing inter-plant interaction.

Once I had a working circuit, I laid out a version in Fritzing, a free open-source platform for designing circuits. With help of my PhD colleague, Michelle Temple, I printed the circuits on transfer paper, and transferred them onto blank copper pcb's using a laminator which she had modified for this purpose. Then I etched out the circuits in a homemade solution, using muriatic acid and hydrogen peroxide.[303] These circuit boards worked ok, however, the etching process was slow, and some of the boards did not perform consistently. Further, I had to drill out the holes in my board manually, which was time-consuming (fig 7.2). So again heeding the advice of my colleague Michelle, I switched to using the Autodesk software Eagle, which is more sophisticated, and allowed me design to my board to be double-sided. I also introduced a ground fill plane, which can improve the stability of the circuit over-all. I then sent the circuits out to Seeed Studio, in Shenzen, and had 20 fabricated (fig 7.3).

[301] IEEE Spectrum, "A Swarm of One Thousand Robots," August 14, 2014, accessed May 2, 2019, https://www.youtube.com/watch?v=G1t4M2XnIhI.
[302] Michael Rubenstein, et al., "Kilobot: A Low Cost Robot with Scalable Operations Designed for Collective Behaviors," *Robotics and Autonomous Systems* 62, no. 7, (2014): 966–975. https://doi.org/10.1016/j.robot.2013.08.006.
[303] The Real Elliot, "Stop Using Ferric Chloride Etchant! (A Better Etching Solution)," instructables.com, accessed May 5, 2019, https://www.instructables.com/id/Stop-using-Ferric-Chloride-etchant!--A-better-etc/.

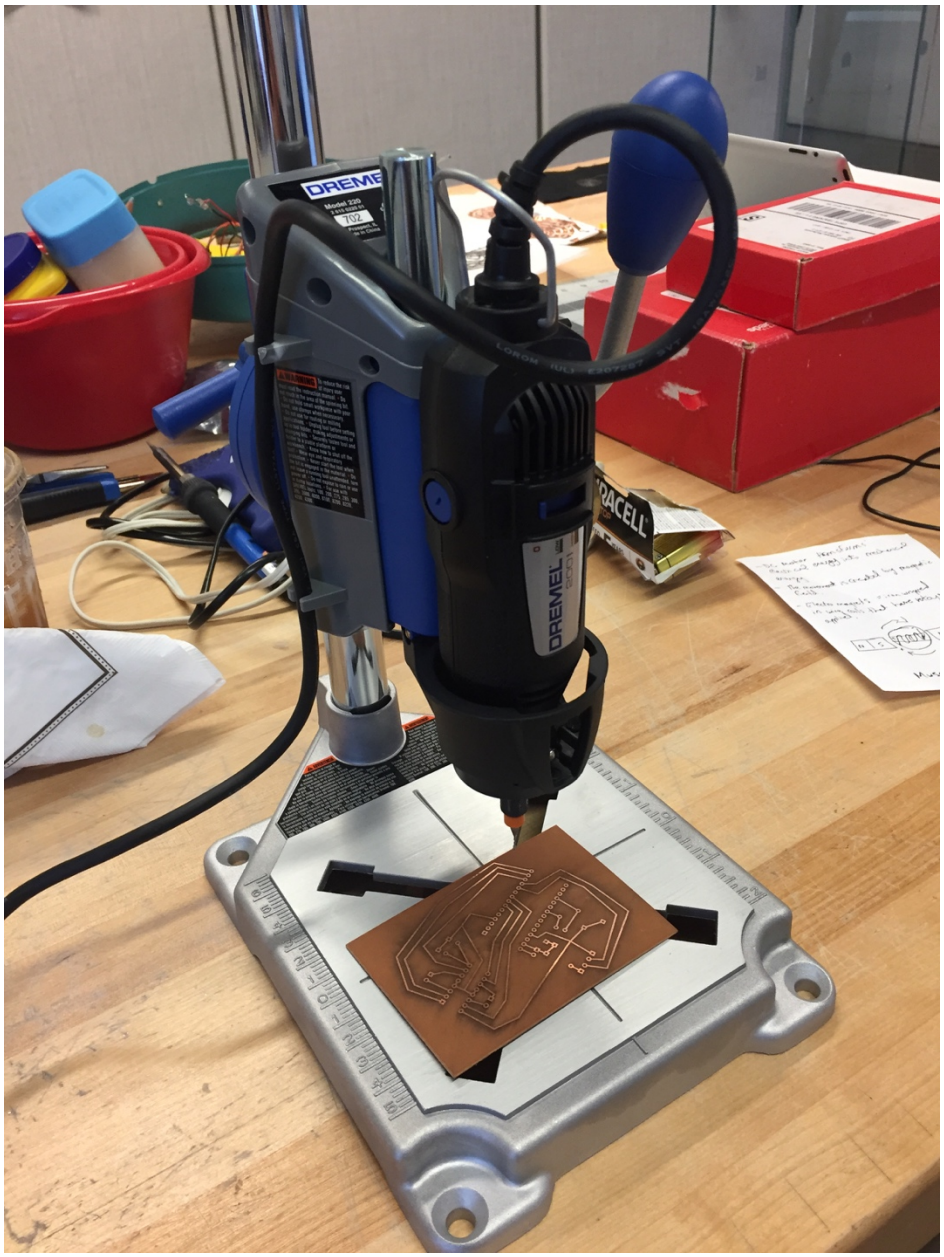


Figure 7.2: Drilling out one of my homemade circuits using a Dremel-press. ***Kathleen McDermott, 2017.***

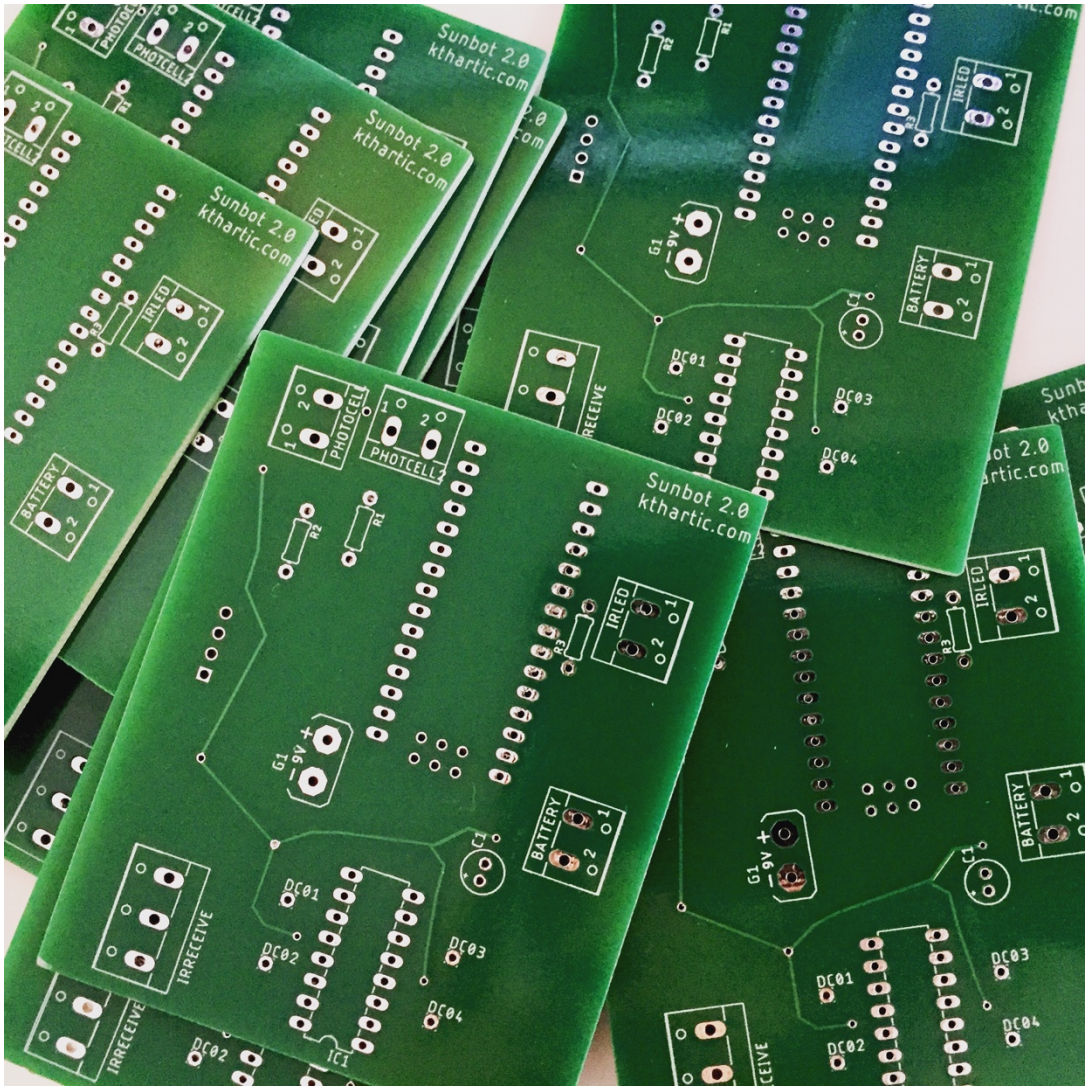


Figure 7.3: Image of professionally fabricated circuits from Seeed Studio. ***Kathleen McDermott, 2018.***

At RPI, I applied for and received a HASS Production grant to help support the cost of buying parts to populate the boards. The biggest cost was for re-chargeable batteries. I had been considering LiPo batteries which as I've briefly explained in Chapter 4, can be expensive and require extra care to ensure they are implemented safely. I ultimately chose rechargeable NiMh batteries, based on advice I read on various robotics forums. They are a bit larger and heavier than LiPo batteries might have been, but cheaper, and have a lower failure rate. I also purchased

chargers, which were the other largest cost in the project. I would have liked to also add solar cells to charge the batteries, but in this version, the cost was not feasible. The other components were relatively in-expensive. I soldered the components onto twelve of the boards, which took several days, and utilized screw terminals to ensure that I could easily remove parts, such as the photocells. The photocells and wheels required additional long wires which I soldered on, to help them reach the circuit board (fig 7.4).

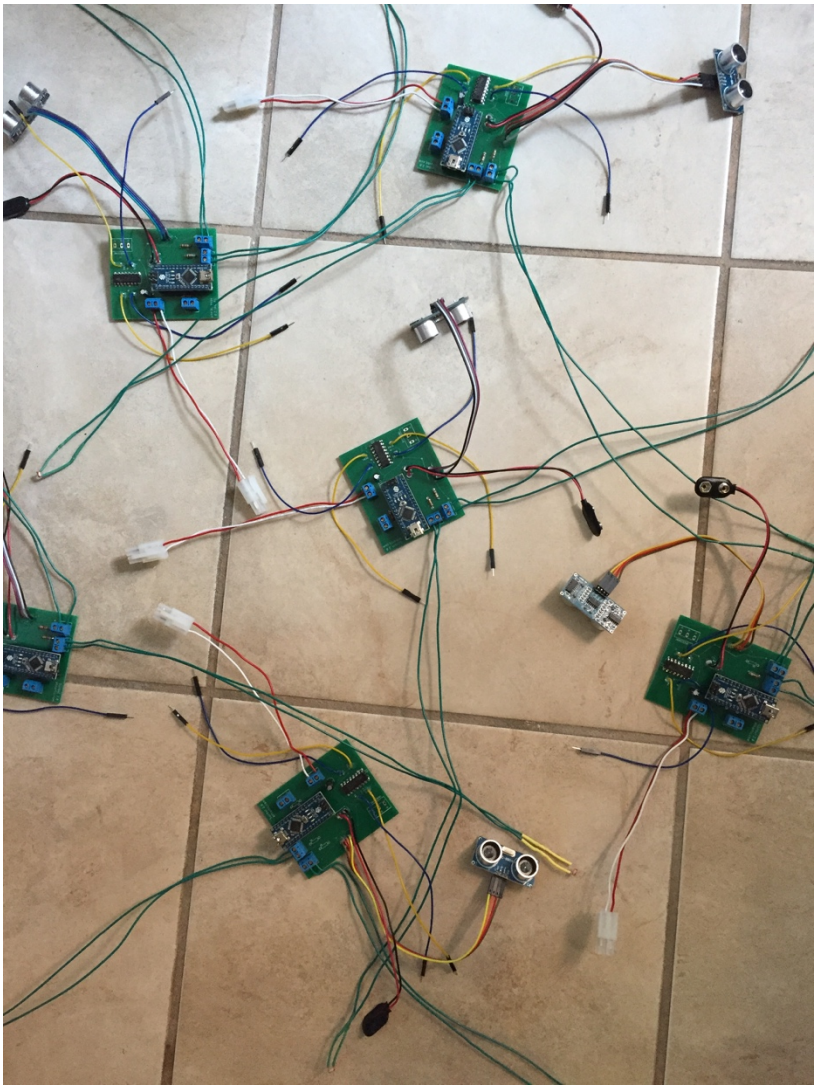


Figure 7.4: Multiple *Sunbot* circuit boards populated with components. *Kathleen McDermott, 2018.*

Next, I was challenged with how to make a replicable body for the *Sunbots* and how to consider that design. I was interested in maximizing the absurdity of the experiment, and thought that hiding the wheels, to give an impression that a regular potted plant had begun to move, would create an uncanny feeling in viewers. Citing the German psychiatrist Ernst Jentsch, Freud attributes uncanny feelings to uncertainty over whether something is alive or not, claiming the feeling can happen with recently dead things, which we cognitively know are dead but our instincts may feel otherwise; as well as with inanimate objects. Freud claims, "a latent animate state that lies close to objects that used to be alive," may become a source of anxiety for those who experience uncanny feelings.[304] (Interestingly, Freud believed women were more susceptible to uncanny feelings than men). I made models in clay and then did some experiments with a plaster mold and latex, because it is biodegradable. The results were poor, for several reasons. One, is that the shape I was attempting to cast was based on a classic flower pot. However, many plant pots taper at the bottom, leaving a narrow base and wider mouth. This is not useful for distributing a load and making a stable robot, and I found many of my robots were too tall/vertical, causing them to easily tip over. Further, the shape I wished to cast was not well-suited to mold making, because it is a hollow volume, so requires a complex 4-part mold that I did not execute as well as I should have, primarily because I underestimated the amount of plaster required and made parts of my mold too thin (fig 7.5).

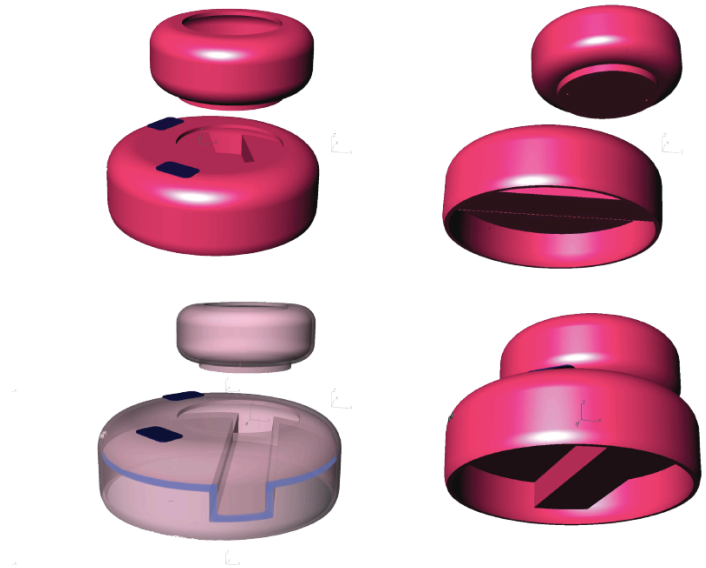
[304] Lydia H. Liu, *The Freudian Robot: Digital Media and The Future of the Unconscious* (Chicago, IL: The University of Chicago Press, 2010), 208.

Figure 7.5: Making a sub-par plaster mold of a clay design for early *Sunbot*. *Kathleen McDermott, 2017.*

Around this time, in 2017, I was participating in a residency at the Museum of Arts and Design in New York, and I met someone who worked at the Times Square Alliance (TSA) who suggested I submit a proposal for an installation in Times Square, because they have a unique lighting situation in their pedestrian plaza, due to all the tall buildings. Re-visiting the design for this new potential context, one of the primary challenges was to consider a design that would allow continual access to the electronics, in order to recharge the batteries and solve any problems over a sustained installation period. I also wanted the robots to be visually unthreatening, because they would be in such a crowded place, where people may be sensitive about electronics. I decided to

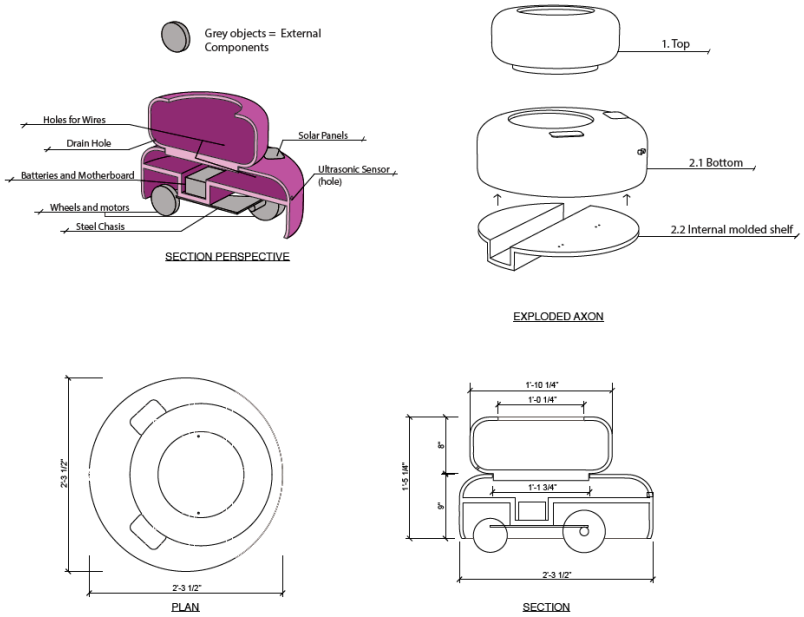
make them much larger than they'd originally been, to avoid anyone tripping over them, and maximize the uncanny effect. This required spec'ing out new electronics, and I looked primarily at electronic wheelchair specifications as a reference. Working in collaboration with an architect, Edward Yujoong Kim, we 3-D modelled a design in Rhino that was very round, and that featured a separate top piece for the plant that would allow it to be easily removed from the robot, and allow access to the electronics. The top piece is slightly off-center, to allow space for a small solar panel. Based on my past experience in fabrication, I assumed vacuum forming would be the cheapest way to produce light-weight multiples of the pots, and the model was made with that process in mind (figs 7.6 and 7.7).

Figure 7.6: Rendering for proposal to install *Sunbots* in Times Square. *Kathleen McDermott and Edward Yujoong Kim, 2017.*



Sunbot Model Rendering 1.2
Kathleen McDermott +
Edward Yujoong Kim
10/25/2017

STRICTLY CONFIDENTIAL



Sunbot Fabrication Drawing 1.1
Kathleen McDermott +
Edward Yujoong Kim
10/25/2017

STRICTLY CONFIDENTIAL

Figure 7.7: Fabrication renderings for large-scale *Sunbots*. *Kathleen McDermott and Edward Yujoong Kim, 2017.*

Unfortunately, after several rounds of communication with TSA and much time spent securing quotes from fabricators and scoping the electronics, the project was projected to be too expensive, and the director of TSA decided not to move forward. I was disappointed, after spending so much time on the submission process, however, I still wanted to realize a version of the swarm. I was back to my original very tight budget and small, hobby electronics. So, I thought it would be best to do something that was the opposite of the TSA proposal, and make the robots as low-cost and easily-reproducible as possible. Working with Open Source Gallery in Brooklyn, we held a workshop, and participants produced bodies for the robots and assembled them, using circuits I'd prefabricated and recycled materials provided by the gallery (fig 7.8). This experience is further detailed in the chapter 8: Workshops.

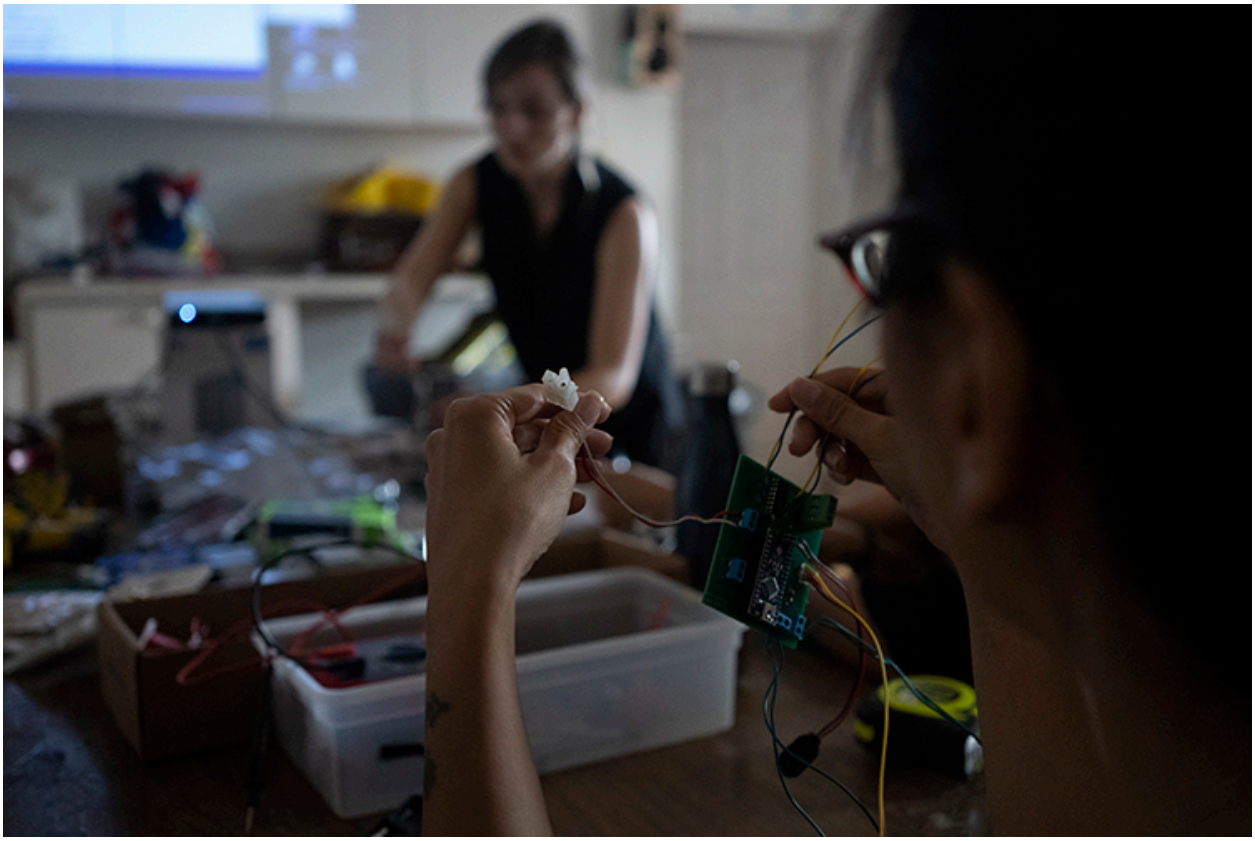


Figure 7.8: Image from *Sunbot Workshop,* Open Source Gallery. *Kathleen McDermott, 2018.*

The collaboratively-made recycled robots that resulted from this experience were very interesting, particularly because each one was different. After the workshop, I collected the robots and filmed them in my apartment over the course of several hours. The resulting video showed that the variation in the robots' designs, including the different placement of their ultrasonic sensors and wheels, meant that some of the robots were much more stable than others. Further, the different placement of their sensors, and their different heights, meant they could not all "see" each other. Their sensors often failed to detect the other robots, and they frequently ran into each other. This became more and more common as the morning progressed, because my apartment is East-facing, and the sun was moving above the apartment, lessening the area of direct sunlight. The time-lapsed video is useful because it is easier to observe the area of sunlight move and diminish. While this occurs, the robots become more restless, as they are programmed to move when they do not have enough light, and they begin to crash into each other at a higher rate. In the resulting video, this behavior appears aggressive; it is as if the plant bots are competing for the light, rather than behaving in a collaborative way (fig 7.9). Again, this analysis is a more complex description of the behavior than what is technically occurring, which is simply an issue of the sensors being placed at heights that do not allow them to detect each other. Nonetheless, I found the results interesting and was motivated to investigate the idea of the swarm further.

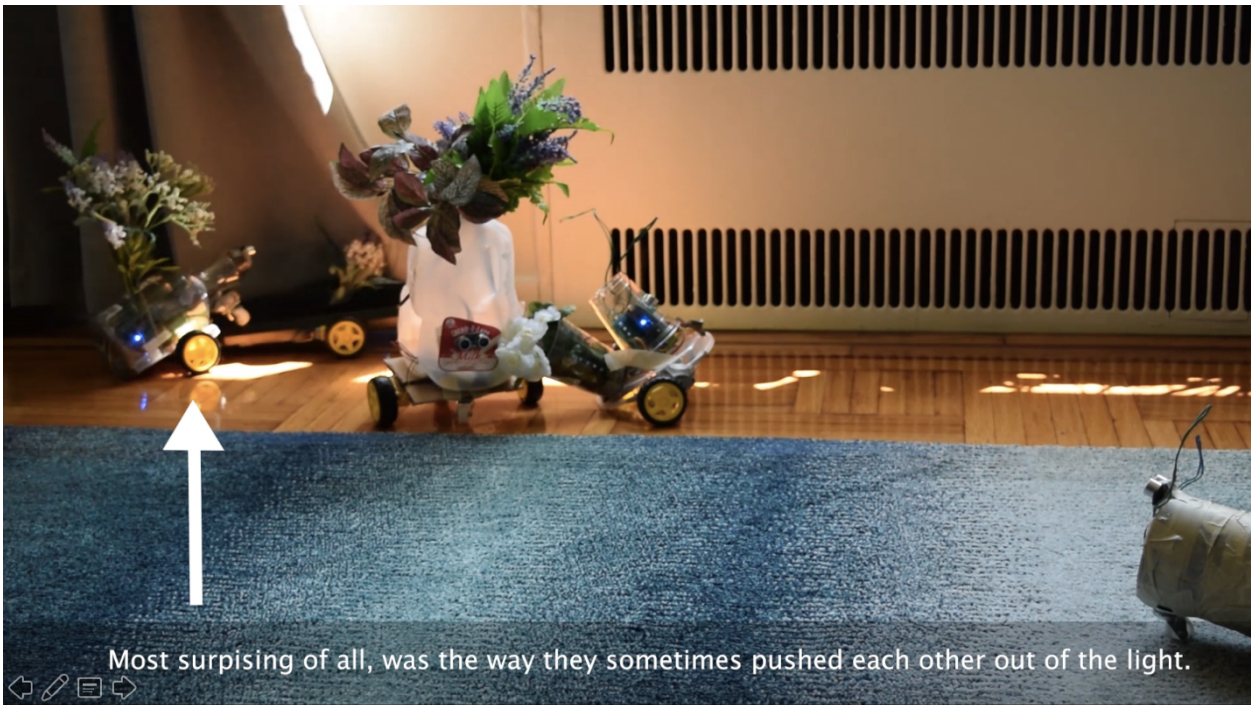


Figure 7.9: Still from *Sunbot Swarm V.1* video. *Kathleen McDermott, 2018.*

7.2.1.1 Video Link

https://vimeo.com/277725450

7.2.2 Second iteration

Approaching the second iteration, I wanted to standardize the robot bodies, so that I could observe how this affected their behavior and if it contributed to a greater feeling of absurdity. I also wanted to ensure that the project would be replicable, and to attempt to use low-impact materials. In my early tests I'd experimented with mold making, and casting materials such as mycelium and "bio-plastic," which I was making from common pantry items, based on recipes I found online, in addition to latex. As I mentioned, the complexity of the shape I hoped to achieve

made for a difficult and expensive mold. In the next iteration, I shifted to a technique called "slicing," which is available in 3-D software such as AutoDesk Fusion 360. I sliced the 3-D model I'd previously made in Rhino for the Times Square proposal, and used a free add-on software called "Slicer for Fusion 360," to generate files for laser cutting the slices (fig 7.10). I first tried generating the files based on the thickness of Amazon boxes, hoping to use recycled cardboard, however, I quickly found that factors such as tape, and more importantly, a lack of flatness, make recycled boxes slightly more difficult to laser cut than new materials. It is not by any means impossible, but some time is required to find a good waste stream (lots of large boxes in good condition), and then to prepare the waste stream for cutting, (flattening under evenly distributed weights for a period of time might help). Again, in the interest of time, I switched to sheets of 2 ply cardboard which I purchased from a craft store. Although the generated files should be an exact science, laser cutters vary in their tolerance, and I found my initial attempt at cutting sheets for the 2 ply cardboard yielded pieces with grooves that were too large, and allowed the material to move around too much in assembly, likely because the laser cutter was not focused properly or required servicing. I then overcompensating, adjusting the files, and made the grooves too tight. Finally, I arrived at a compromise, that was on the loose side, because I found a looser fit easier to assemble. I added dabs of hot glue to prevent the pieces from moving once they were assembled (Fig 7.11).

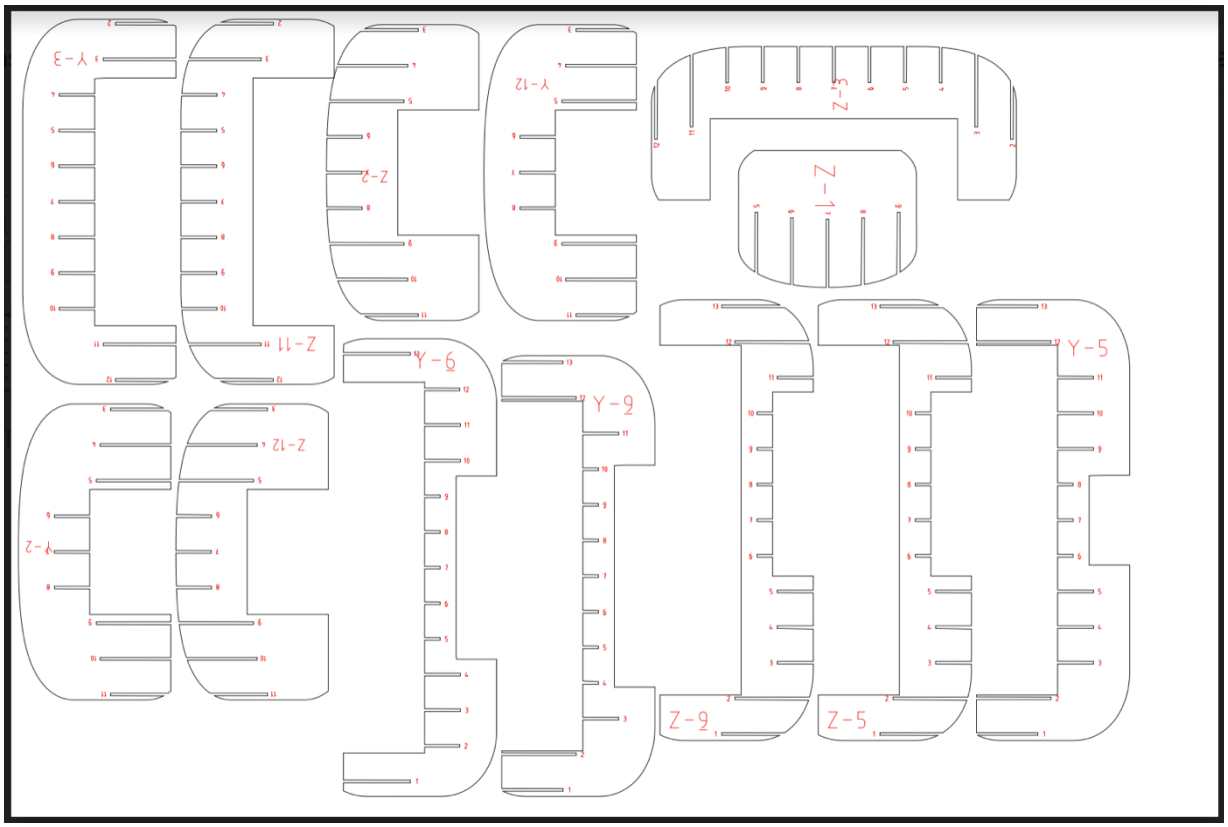


Figure 7.10: A page of "slices" for laser cutting generated by Slicer for Fusion 360. ***Kathleen McDermott, 2018.***

Figure 7.11: Assembled robot bodies using slice-formed cardboard. ***Kathleen McDermott, 2018.***

The robot chassis, the section that the wheels attach to and the circuit board sits on, presented a different challenge because my original design had proposed a vacuum formed piece that would be integrated into the base of the robot body. Using the slice-form technique for constructing this did not feel like a good equivalent, because the resulting waffle structure would not yield a good surface for attaching the wheels. Instead, I referenced other chassis I have

purchased in the past and some I saw online, to make a custom chassis design that would allow space for the electronics to sit beneath the robot body. I also made this out of cardboard and hot-glued it (fig 7.12). I ran pliable galvanized wire through the chassis to the robot base to keep the structure securely in place, on top of the chassis. I added the electronics and tested the robot, finding I had to adjust the cut files further to accommodate the size of the ultrasonic sensor. Once I had a version of the robot that appeared stable, which I worked on over the course of several weeks, I began making multiples. Laser cutting and assembling the body of a single robot took between three and four hours. I ultimately made six (fig 7.13).

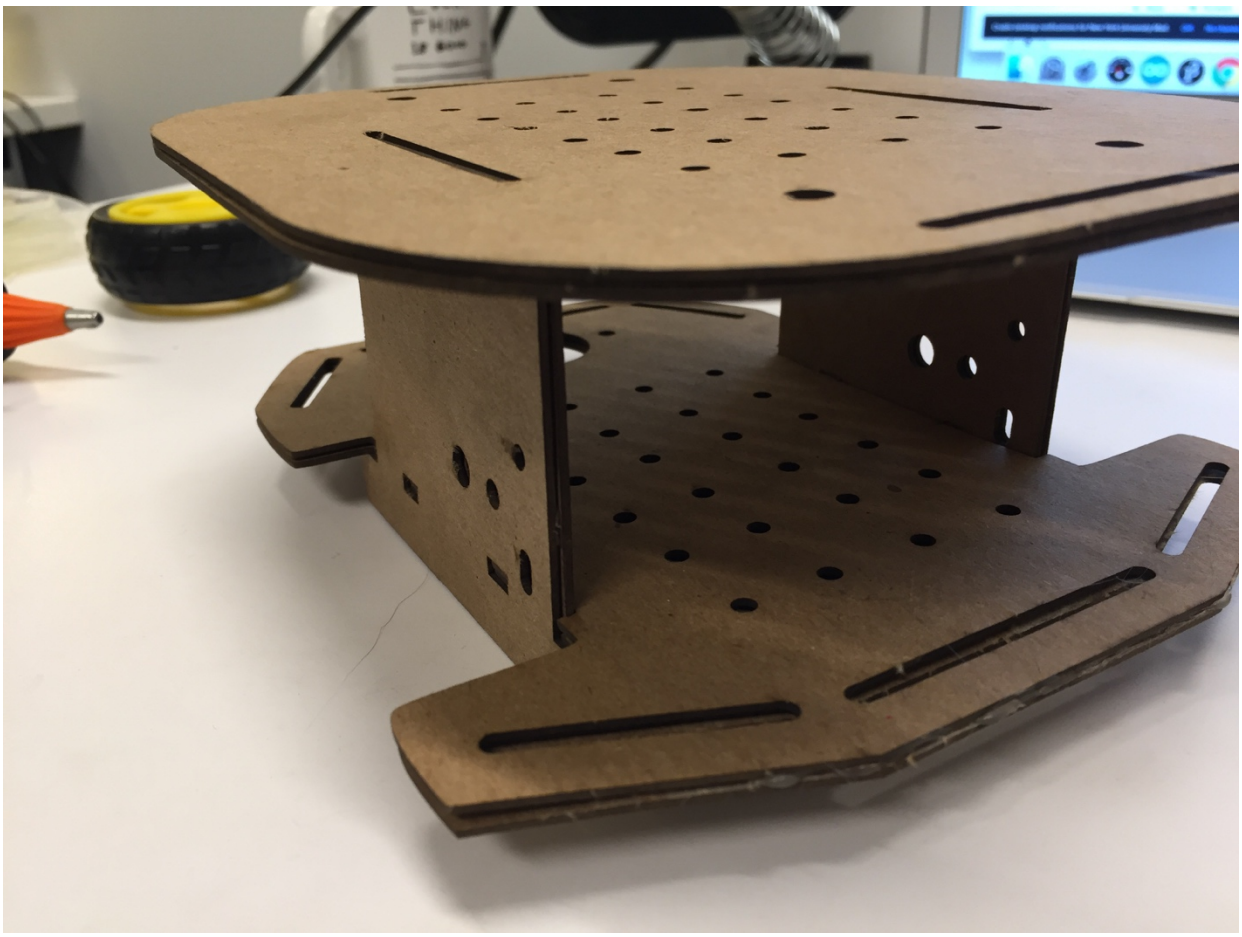


Figure 7.12: Assembled chassis using laser cut cardboard. ***Kathleen McDermott, 2018.***

Figure 7.13: Assembled *Sunbot Swarm,* v.2. *Kathleen McDermott, 2018.*

I tested the six robots in my apartment, using fake plants, in a format that echoed the previous swarm test. The video of this test was less interesting. Two of the bots were not performing well, because the cardboard chassis was not rigid enough, and if it shifted or bowed, it would cause the wheels to fall off. All of the bots were more still overall, perhaps because I'd pulled up my rug for this test, (to accommodate the less stable wheels) and the varnished, wooden floors may have been allowing more light to bounce around the room. I several times put my hands over the sensors to cast a shadow over them and cause the robots to move, in order to demonstrate that they were working in the video. Improved obstacle avoidance also meant that when the robots

were moving, they were better at avoiding each other. This was good in theory, but for the purposes of the video, it really only left two possibilities for the robot behavior. They either had enough light, and were still, or they did not have enough light and were moving. However, there was only one "correct," location for the light, which was near the window. The resulting boring video, was indicative of the simplicity of the lighting condition I'd provided, which is something that was also observed in the relation to Grey's tortoise bots, "Because the world that Walter put them in was complicated, their behavior was complicated."[305] When comparing the first *Sunbot* video, taken outside in Maine, to the second *Sunbot Swarm*, I believe the first video is more interesting because the environment is more interesting and complex. The wider variety of sensory input enabled a wider variety of robot behavior, as well as more fantastic implied narrative—that a plant robot was on the loose in the wild. For the third iteration, I decide it was important to take the robots back outside.

7.2.2.1 Video Link

https://vimeo.com/277725450

7.2.3 Third Iteration

Taking the robots outside would require a more reliable and stable chassis, because sidewalks and roads, though flat in a general sense, have much more surface variation than the

[305] Larissa MacFarquhar, "The Mind Expanding Ideas of Andy Clark."

hardware floors in my apartment, and I did not what the wheels to fall off every time the robot approached a crack in the sidewalk. I also wanted the robots to carry real potted-plants, which are much heavier than fake ones. I switched to laser cut acrylic for the chassis, which I assembled using an acrylic-bonding agent. My first acrylic test still had a high-rate of failure (in the form the wheels popping off). Through much time spent lying on the floor trying to peer under the robot while it moved, I observed that the third wheel, a free-flowing caster attached to the bottom of the chassis, was pitching the whole bot forward and shifting its balance. The motors were also not completely flush to the sides of the chassis, due to the fact the holes I'd cut for them to pass-through were a little too small. This issue had been less-apparent in the cardboard version, because cardboard is more pliable, and I'd been able to force them through. After changing the file, I eventually arrived at a chassis which was stable.

Around this time, I began to consider how to conduct the test in a way that could more directly allude to mass-migration, and feel a bit more fantastic. Through feedback at various phases, I'd found that audiences were often struck by the usefulness of the design, and whether it would make a good product, and less likely to critically consider the implications of plant-based robots. To help make the sunbots more fantastic, I wanted to reference a cyborg or a spacesuit more directly in the design, and made a Photoshop rendering in which the robots were enclosed in plastic domes (fig 7.14).

Figure 7.14: "Hills alive with Sunbots," ***Kathleen McDermott, 2018.***

I purchased clear plastic hemispheres from Canal Plastics in Manhattan. I ultimately found that using two hemispheres together, allowed me more space for the plant, but the challenge with was that the plastic domes became a sphere, and I had to consider how to secure it to the robot body. Through testing I've found that having all the elements of the robot tightly secured greatly improves performance. If elements are shifting their weight around while the robot is moving, it is much more likely to fall over, or lose a wheel. I decided to use threaded rods, with I ordered from MacMaster Carr, because I needed an exact length. I also ordered nuts and bolts for joining the hemispheres. I laser cut the six chassis again to add holes for the threaded rods to pass through. The rods pass through the chassis and are secured with a nut at the base. They then pass through the waffle structure of the cardboard body, (the design of which was very useful for these tests, because it has so many openings), and through the plastic domes, which I had drilled holes in. I

secured the rods with nuts on the inside of the plastic domes. This was not a perfect system, over the course of sustained testing some of the nuts loosened, allowing the chassis to shift and destabilizing the whole robot. A quick way to prevent this would be to use thread-stopper, a kind of silicone which fills in the threads at the base of a rod, to prevent a nut from slipping. I also would like to find a way to secure not only the dome, but the top planter itself. I attempted to do this by laser cutting small squares that would fit into the waffle structures of the top planter piece, but this was imperfect and requires further iteration. This assembly process is further detailed in the full tutorial at: plantbots.org

The final challenge for preparing the plantbot-nauts, was finding a good flower pot to fit inside the structure of the robot. I had been using off-the-shelf plastic flower pots but I didn't like the way the plastic lip looked, because it was not flush with the structure. I wanted to cut the lip off with a band saw or scroll saw, but I did not have access to those tools at that time, and I found that a jig saw cracked the plastic. After much searching, I found extra-large cardboard frozen yogurt cups had the exact dimensions I required and I repotted six of my houseplants accordingly. Ironically, I'd bought many of those plants with the ambition of testing them in my sunbot swarm a year prior, but had vastly underestimated the time it would require to design and build a reliable swarm for such a low cost, (less than $100 a bot). In the interim, the plants had grown quite a bit, which was nice.

I documented the *Sunbot Swarm* in Prospect Park (figs 7.15 and 7.16), with the help of the director of Open Source Gallery, and two teen volunteers from a local high school, on a fairly warm and sunny Saturday morning in March. The park was crowded and the bots attracted a lot of attention. Some highlights include a man who approached to tell me about his love of plants, and how he'd gotten a "people plant," that seemed to have led to his in-laws moving in with him,

(by attracting people to his home). He was considering getting rid of it. Another older man saw the plants from afar slowly moving and asked me if they had turtles under them. I liked that analysis, and the way it relates to the tortoise robots which inspired this investigation. A child nearby shouted "robots!" and the man reflected on how quickly the child had made the correct guess. There was definitely an immediate reaction in bystanders to demand how the plants were moving, with many people guessing they were motivated by light or temperature. The high-volume of engagement was actually a little overwhelming. Overall, there were no combative reactions, that I can recall, and the interactions were easier than those I've had while filming wearables for humans. Based on my experience in Prospect Park, I might conclude that "wearables," for plants are less threatening or disturbing to viewers than strange wearables for humans.

Figure 7.15: Sunbot Swarm v.3, *Kathleen McDermott, 2019.*

Figure 7.16: Sunbot Swarm v.3, *Kathleen McDermott, 2019.*

I have many hours of footage from this test which merits another look, but for the first pass, I attempted to cut the video in a way that would make the functionality of the robots clear. I would like to also see if I could edit the footage in a way that allows a narrative to emerge. I definitely started filming too early in the day, when the high-volume of light resulted in very still robots. By late afternoon, when the light was low and dappled through the trees, allowing some very interesting behavior to emerge, the bots had already been "on" for several hours, and several of the chassis had become loose. A few were destabilized from riding off the paved path into the grass, which in some places led to a steep drop-off. No bots were permanently damaged and the outcome could definitely be improved by planning my shots more carefully based on the sun's location, and training my production assistants more explicitly on how to handle the bots.

7.2.3.1 Video Link

https://vimeo.com/322689494

7.3 Conclusion

A consistent rule in the wearables I created for humans in this dissertation, has been that the garments cannot be controlled by the wearer, they respond to stimuli in the environment, outside the wearer's control. In the context of humans, I've considered this an absurdist subversion of the logic of control and domination present in commercial technology design. However, when designing wearables for non-humans, questions of control shift. There is an irony in implying agency within plants, through a robotic system that has been dictated by a human designer. In future iterations, I would like to further explore systems which might allow the plants to have more control over the robots' movements. I would also like to more carefully consider which types of plants are best-suited to this investigation. For the latest, enclosed version, this may require looking into terrarium and greenhouse research.

There are many opportunities to improve the thoughtfulness of the design, in respect to the plants' health, particularly in regard to factors such a temperature, water, and whether the plants should be programmed to avoid humans. Conceptually I would also like to further explore the idea of plant-anxiety, which may be considered parallel to the technologically-enabled anxiety I have traced in humans using wearables. Despite the unresolved issues, testing the robots in an iterative way has allowed me to observe their behavior firsthand and to visually illustrate some of the more abstract concepts which have concerned me throughout this dissertation. The simple investigative framework has branched out and led to a host of questions, which can reflect back to also question the way we design wearables for humans.

8. WORKSHOPS

8.1 Artists Sharing Knowledge: Fluxus as Precedent

Each case study in this dissertation has been presented as both a conceptual project situated in relation to a larger philosophical framework, and as literal experiment accompanied by a set of instructions for replication, hosted on urbanarmor.org. I began sharing tutorials while completing my MFA in 2014, in part to subvert the "product-like" qualities of some of the work I was producing. Giving away instructions for creating the works in the series was a way to immediately subvert a potential commodification of use-value in a capitalist system. As I have stated in the methods chapter of this text, giving away instructions for executing artworks is also a practice that was utilized by Fluxus artists working primarily in the 1960s, who were influenced by Dada absurdist tactics.

Fluxus artists were particularly interested in subverting systems of value associated with the art-market, and according to Dorotheé Brill, were, "aiming at the creation of works that were cheap and easy to produce, and were consequently available without limit and economically worthless."[306] Fluxus practice often sought to blur the distinction between art events and everyday life. Hannah Higgins explains that the term intermedia was used within Fluxus to describe, "the field between the general idea of art media and those of life media…a dynamic interstitial space between media forms and between art and life structures."[307] These principles of producing easily-distributable art pieces that blur the boundary between art and life, are illustrated by Fluxus scores,

[306] Dorotheé Brill, *Shock and the Senseless in Dada and Fluxus* (Hanover, NH: Dartmouth College Press, 2010), 123.
[307] Hannah Higgins, *Horizons, The Poetics and Theory of the Intermedia,* ed. Dick Higgins (Carbondale, IL: South Illinois University Press, 1984), 91.

"sometimes known as proposal pieces, propositions, or instructions."[308] The scores are primarily instructions for producing performances, which were printed on cards and distributed as boxed collections, and well as pamphlets, booklets, and large-format sheets of paper. Friedman, Smith and Sawchyn note,

> The booklets were highly portable. Even more important, they were easily copied using what was then the new Xerox technology. As a result, Great Bear pamphlets (produced by Fluxus artist Dick Higgins) spread an idea about what art–and performance art–could be to a vast and ever wider circle of artists and critics interested in new ways of working.[309]

The editors of the Fluxus Performance Workbook, in keeping with Fluxus tradition, have made their collection of Fluxus scores available for free as a pdf. Some scores from the workbook include:

George Brecht

Drip Music, Flux Version 1

First performer on a tall ladder pours

water from a pitcher very slowly down into

the bell of a French horn or tuba held in

the playing position by a second

performer at floor level.

1959

[308] Ken Friedman and Owen Smith, "Introduction," in *The Fluxus Performance Workbook*, ed. Ken Friedman, Owen Smith and Lauren Sawchyn (Melbourne, Australia: Performance Research e-Publications, 2002), 1–2.
[309] Friedman and Smith, *The Fluxus Performance Workbook*, 2.

Hi Red Center

Street Cleaning Event

Performers are dressed in white coats like laboratory technicians. They go to a selected location in the city. An area of a sidewalk is designated for the event. This area of sidewalks is cleaned very thoroughly with various devices not usually used in street cleaning, such as: dental tools, toothbrushes, steel wool, cotton balls with alcohol, cotton swabs, surgeon's sponges, tooth picks, linen napkins, etc.

Date Unknown[310]

Yoko Ono

Laundry Piece

In entertaining your guests, bring out your laundry of the day and explain to them about each item. How and when it became dirty and why, etc.

1963

[310] While the Fluxus Workbook dates the instructions as unknown, the MOMA dates this piece as originating in 1964. Hi Red Center, "Street Cleaning Event," MOMA, accessed March 10, 2019, https://www.moma.org/collection/works/127373?association=associatedworks&locale=ja&page=1&parent_id=196412&sov_referrer=association.

Yoko Ono

Lighting Piece

Light a match and watch it till it goes out.

1955

The differences in the instructions I've selected here hint at the variety of implications and motivations within the Fluxus practice of sharing information. Brecht's piece is most explicitly related to musical performance, and employs a traditional instrument, even though it is being used in a non-traditional way. Like many Fluxus performances, Brecht's work is clearly influenced by John Cage, whose famous piece, *4'33"* (1952) was composed entirely with silence. During its inaugural performance, pianist David Tudor sat silently on stage, keeping time on a stopwatch and opening and closing the lid of a piano to signify the transition between movements for 4 minutes and 33 seconds.[311] John Cage was likely inspired by Dada concerts that incorporated atypical objects and technologies into music production, such as a concert arranged by Stefan Wolpe in 1920 that featured eight phonographs playing Beethoven's Fifth at different speeds. Paul Hindemith and Ernst Toch also performed with phonographs at a "1930 Gramophone Concert," a concert witnessed by a teenage John Cage.[312] Cage and other Fluxus artists were also inspired by Zen Buddhism. Lewis Hyde cites a lecture by Japanese Buddhist scholar D.T. Suzuki at Columbia University in the late 1940s as a key source for Cage's thoughts on incorporating chance into his composition practice.[313] Cage spoke about chance as a process for becoming freed from the ego,

[311] David Revill, *The Roaring Silence: John Cage: A Life* (New York: Skyhorse Publishing, 2014).
[312] Alex Ross, "The Record Effect: How Technology Has Transformed Music," *New Yorker,* June 6, 2005, accessed January 30, 2018, http://www.newyorker.com/magazine/2005/06/06/the-record-effect.
[313] Hyde, *Trickster Makes This World*, 141-42.

which tends to limit the average person's scope of interests to things they consider to be within their taste.[314] *4'33"* is often discussed in terms of its radical expansion of what could be considered music and meaningful sound—the noises of the space and the crowd formed the composition in *4'33"* as the performer sat in relative silence. Fluxus scores and subsequent avant-garde music practices, such as that of Pauline Oliveros, continued this tradition of challenging systems of value within music, through performance. Oliveros, in particular, according to Martha Mocklus, created pieces, "committed to challenging sexism and classicism in Western classical music and democratizing music-making for women of all abilities."[315]

Fluxus scores such as Hi Red Center's *Street Cleaning Event*, on the other hand, were less in dialogue with music and more so engaged with visual performance art. *Street Cleaning Event*, is a democratic take on performance art, because it is intended to be performed for free, in public places. The performance instructions I have included from Yoko Ono, on the other hand, do not include a stipulation that they be executed in public. *Laundry Piece* may be considered a score for a private performance, and *Lighting Piece,* which never mentions an audience, could be considered a score for a meditation. Because they do not require an audience, Ono's scores are particularly accessible to potential executers of the scores, allowing almost anyone to enact the artistic gestures.

A common thread across Fluxus scores, is that the instructions have to do with completing unusual actions, often in public, using objects in ways that subvert their use-value, (toothbrushes to clean sidewalks, water in a tuba), and there is often an emphasis on duration, which can give time and space for reflection. Completing a Fluxus score is a conceptual exercise, not a technical

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[314] Hyde, *Trickster Makes This World*, 143.

[315] Martha Mockus, *Sounding Out: Pauline Oliveros and Lesbian Musicality* (London: Routledge, 2007), 2.

exercise. This a key difference between Fluxus scores and the practice of sharing technical instructions present in the Open Source movement. However, there has been an increasing call for criticality within the Open Source and Maker movements, which has contributed to the emerging body of thought known as Critical Making.[316] Critical Making attempts to incorporate conceptual reflection into technical instructions, in order to encourage a thoughtful making practice.

8.2 Critical Making

The Maker Movement operates on the belief that "making is fundamental to what it means to be human,"[317] and that by sharing knowledge related to making things, the world can become a more equitable place. Mark Hatch's *Maker Manifesto*, includes sharing as one of its primary tenets, and Hatch claims, "With access to the right kind of tools, you can experience your own industrial revolution in a matter of weeks."[318] However, statements such as Hatch's have been criticized for overstating the accessibility of technical knowledge and means. In her highly shared think piece in *The Atlantic Monthly*, "Why I Am Not a Maker," Debbie Chachra takes issue with the implication that *making things* is a more productive or noble pursuit than engaging in other types of labor, "The cultural primacy of *making*, especially in tech culture—that it is intrinsically superior to not-making, to repair, analysis, and especially caregiving—is informed by the gendered history of who made things, and in particular, who made things that were shared with the world,

[316] Matt Ratto, "Critical making: Conceptual and material studies in technology and social life," *The Information Society* 27, no. 4 (2011): 252-260.
[317] Mark Hatch, *The Maker Movement Manifesto: Rules for Innovation in The New World of Crafters, Hackers, And Tinkerers* (New York: McGraw-Hill Education, 2014), 11.
[318] Hatch, *The Maker Movement Manifesto,* 22.

not merely for hearth and home."[319] And though much of the Maker movement ideology seems to imply that consumers can turn into makers, and therefore subvert a capitalist agenda, Chachra rightly picks up on the way in which many people interested in the Maker movement want to gain skills in order to build and prototype commercial products. Chachra adds, "Making is not a rebel movement, scrappy individuals going up against the system. While the shift might be from the corporate to the individual (supported, mind, by a different set of companies selling a different set of things), it mostly re-inscribes familiar values, in slightly different form: that artifacts are important, and people are not." In addition to the capitalist association with Maker-related products and education-initiatives, Chachra is picking up on a kind of bravado that can emerge in fabrication spaces, making them potentially unwelcoming to people with different abilities and people with marginalized identities.[320]

Chachra's points are echoed in Critical Making methodologies which seek to reference models for knowledge sharing that can be considered more self-reflective and accessible. In their volume on Critical Making, Matt Ratto and Megan Boler point to both 1960s counterculture, when fixing things oneself was seen as an alternative to the prevailing tendency to, "pay someone to solve your problems for you;" and to the "Zine" culture of the 1980s and 1990s, which the writers cite as instrumental to both Punk and feminist movements.[321] Ratto and Boler build their volume on DIY practices around John Hartley's concept of "DIY Citizenship." "According to Hartley, the

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[319] Debbie Chachra, "Why I'm Not a Maker," *The Atlantic,* January 23rd, 2015, accessed November 20, 2017, https://www.theatlantic.com/technology/archive/2015/01/why-i-am-not-a-maker/384767/.

[320] Grace Wingo and Kimberly M. Sheridan, "Beyond the Manifestos: Equity and Learning in Makerspaces," in *Makers, Crafters, Educators: Working for Cultural Change*, ed. Elizabeth Garber, et. al, (New York: Routledge, 2018).

[321] Megan Boler and Matt Ratto, "Introduction," in *DIY Citizenship: Critical Making and Social Media,* ed. Megan Boler and Matt Ratto (Cambridge, MA: MIT Press, 2014), 9.

DIY Citizen is one who creates their identity and individuality through a process of choosing semiotic material on offer."[322] The "material on offer," alludes to the fact that contemporary DIY culture is vast to say the least. Websites like Khan Academy enable students to teach themselves to code;[323] Instructables offers pictures, videos, and text on how to make or modify everything from a solar phone charger to a popsicle-stick-based robotic arm;[324] Hackaday focuses specifically on clever modifications of consumer electronics, such as the Roomba;[325] and Makezine.com acts as a library for all things Maker, featuring projects, tutorials, and resources for buying supplies, many of which utilize popular products like Arduino.[326] There is no shortage of information on making things online—but one could argue that there *is* a shortage of critical framing.

In an abstract titled "Being Complicit: Beyond Critical Making," at the 2018 Society of Literature, Sciences and the Arts conference, Ratto reflects on work carried out in the Critical Making lab in Toronto, writing, "Ultimately, our most successful projects combine feelings of being complicit and the development of pragmatic capacities to produce real change."[327] Ratto was ultimately not present to deliver this talk, but one of his colleagues from the critical making lab spoke on his behalf, and discussed their effort to seed tutorials with critical questions, and to caution students away from "careless making." Similar values are espoused by Garnet Hertz in his project "Disobedient Electronics," the introduction to which highlights the following points:

> 1. Building electronic objects can be an effective form of social argument or political protest.

[322] Boler and Ratto, "Introduction," in *DIY Citizenship,* 11.
[323] Khan Academy, accessed April 26, 2019, https://www.khanacademy.org/.
[324] Instructables, accessed April 26, 2019, http://www.instructables.com/.
[325] Hackaday, accessed April 26, 2019, http://hackaday.com/.
[326] Makezine, accessed April 26, 2019, http://makezine.com/.
[327] Matt Ratto, "Being Complicit: Beyond Critical Making," Abstract, *Society of Literature, Sciences and the Arts, Toronto* (2018), accessed December 1, 2018, http://litsciarts.org/slsa18/.

2. DIY, maker culture and local artisanal productions can have strong nationalist and protectionist components to them–in some senses, populism can be seen as the rise of the DIY non-expert.

3. Critical and Speculative Design (Dunne & Raby) are worthwhile approaches within industrial design, but perhaps not adversarial enough to reply to contemporary populist right-wing movements (Brexit, Trump & Le Pen). Questions like "Is it moral to punch Nazis in the face?" should be answered with smart alternatives to violence that are provocative pieces of direct action.

4. If we are living in a post-truth time, we should focus on trying to make progressive arguments and facts more legible and engaging to a wide and diverse audience.

5. The fad of 'Maker Culture' is over. Arduinos and 3D printers are fascinating things, but the larger issues of what it means to be a human or a society needs to be directly confronted.[328]

Hertz's collection features a series of examples of DIY electronics-based artistic and interventionist projects that are explicitly related to protest, such as *Jammer* created by Pedro G. C. Olivera & Xuedi Chen, "This short-range personal jammer was created to block all outside communications to the phone while still allowing the user to access their camera and features without worrying about their personal information being collected and used against them."[329] Hertz's project is reminiscent of *Recipes for Disaster: An Anarchist Cookbook*, a "contribution to the public toolkit," which features tips on how to live life outside systems of currency; tips such as how to forage for free food, perform one's own cervical exam and how to make a record player from bicycle parts.[330] In both of these projects, it is the *type* of instruction shared that makes the project critical.

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[328] *Disobedient Electronics*: *Protest*, ed. Garnet Hertz (Toronto, Canada: The Studio for Critical Making, 2018), 2, accessed April 26, 2019, http://www.disobedientelectronics.com/resources/Hertz-Disobedient-Electronics-Protest-201801081332c.pdf.

[329] Hertz, *Disobedient Electronics,* 26.

[330] CrimethInc Workers Collective, *Recipes for Disaster* (Portland, OR: Olympia, 2005).

I have relied on similar logic in sharing my instructions for absurdist electronics. Because these projects are explicitly designed to challenge or address issues of technologically-enabled anxiety, the instructions for making the projects can be considered critical. I would add, that because the instructions are primarily for *wearable* electronics, they are in dialogue with a history of knowledge sharing inherent to domestic labor and craft.[331] Prior to the mass-production of garments, it was common for women to purchase and share patterns for creating their own clothes.[332] Elizabeth Waylan Barber explains that the production of garments was historically a collaborative practice for women. She points to researchers studying the weave of a cloth from around 1300 BC in Denmark, who concluded, based on the way the threads cross each other that, "several weft bobbins were in use at once. That is, three women had to have been weaving on the cloth simultaneously, passing the bobbins to each other as they met in the middle somewhere and then changing shed."[333] Barber also observes that even in subsistence-survival societies, evidence of ornate garments have been found, indicating that a significant amount of time was put into "decorating people and things with efficacious symbols believed to promote life, prosperity and safety."[334] As I have observed in Chapter 2, garments have also historically been a tool for transformation, and for constructing identities in public space, so information on how to create garments can potentially become a tool for empowerment.

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[331] An association between craft and Maker movements has also been drawn by Garber, Hochtritt, and Sharma, "Crafting and making are knit close together. This volume is focused on making and crafting as cultural change." Garber, "Introduction," 2.

[332] Maureen Daly Goggin and Beth Fowkes Tobin, *Women and The Material Culture of Needlework and Textiles, 1750-1950* (Burlington, VT: Ashgate, 2009).

[333] Elizabeth Wayland Barber*, Women's Work* (New York: W.W. Norton & Company, 1995), 87.

[334] Barber, *Women's Work,* 94.

However, it must be acknowledged that there are many limitations to following the instructions linked to this dissertation. Many of the projects utilize Arduino-based microcontrollers, which can become expensive. It is possible to replicate the projects less expensively, for example, by using an Arduino-clone produced by a third-party manufacturer, and by building motor control circuits instead of purchasing motor-control shields. However, these workarounds require additional skills. Arduino-clone boards often require additional drivers and can be difficult for beginners to trouble-shoot. Laying out a motor-control circuit on a blank PCB can be difficult, and etching out a custom circuit is a specialized skill. Completing any of the projects in this dissertation from start to finish would likely take a considerable time commitment and a fair amount of trouble-shooting. I have been motivated to complete these projects because they constitute a large part of my artistic practice, and I normally have an idea for additional video documentation in which the pieces will be utilized. Casual users and beginners are unlikely to share that motivation. However, although users may be unlikely to complete a project from start to finish, the tutorials may still be useful for demonstrating how a creative electronics project is designed, and readers may apply select aspects of the tutorials to other projects. I would argue that this is a more desirable form of engagement with tutorials than a verbatim copy. This is also the way in which I approach online information, as I have detailed in the previous case studies; many of the designs I have created build on a piece of information I found elsewhere, and simply applied differently. Another reason for including instructions for recreating these objects is to ensure that it is at least *possible* to replicate the design explorations, even if it is not easy to do so, and that other researchers will have the potential to build on these investigations as an academic project.

However, while it is not my priority to ensure that people follow the instructions I have provided to a letter, I must acknowledge that it is difficult to claim that sharing this information is

a democratic gesture, if I cannot gain feedback on the experience of engaging with this material as a beginner. A desire to further explore the effectiveness of sharing critical technological knowledge, was one of my primary reasons for developing the Critical Wearable Workshop series, and subsequent workshop iterations, which I will outline below.

8.3 Critical Wearables Workshop I

8.3.1 Workshop Planning and Design

The Critical Wearables Workshop is an 8–10 week workshop series that I designed within the framework of a course at RPI, titled "Art, Community and Technology (ACT)," taught by Professor Branda Miller in Spring 2016. The key premises underlying the workshop were A.) Humans have always been incorporating technology into their senses of self, and now seem to be doing so at a faster rate, and B.) The types of commercial wearable technologies that are being produced currently might be coming from a limited design perspective, and therefore may limit the types of identities we can forge through wearing this technology. Commercial technology may also not be distributed equally, due to income inequality, and may be inherently designed to create better consumers, not better people. C.) Exploring these ideas in person, in a workshop format, may be a more effective means for judging the critical properties of the tutorials I have been putting online.

Based on these points, the primary goal of the workshop series was to help students cast a critical eye toward consumer technology, and to do so in part by making things themselves. I presented the workshop framework to Lana Hower, a literature teacher at Tech Valley High School in Albany, after receiving an introduction from Professor Miller. Ms. Hower was receptive to the

idea of allowing the workshop during school hours, and thought it might have a symbiotic relationship with her literature Senior Project module, which was designed around issues of stereotypes. Ms. Hower and I agreed that after an initial introduction to the material in her unit on stereotypes, her students would have the option to join my workshop to create a creative project using wearable technology, that would address some of the material in the literature unit, or they could choose to do a theatrical or writing-based project with Ms. Hower instead.

Professor Miller also put me in touch with Barbara Ruel and Elizabeth Herkenham at RPI, who lead diversity and outreach initiatives in the engineering department, and who subsequently facilitated a meeting between myself and researchers at RPI's Lighting Enabled Systems and Applications Center (LESA). LESA faculty Dr. Ken Connor and Dr. Bob Karlicek agreed to financially support my need for supplies for the workshop series, and also offered guidance in designing my curriculum and completing the IRB protocol submission process.

Upon receiving approval and finalizing the IRB,[335] I gave a presentation introducing the ideas behind my work and the workshop series to the students in Ms. Hower's class, and she left them with the option to join the workshop series or not. Working in the context of an education system in this way was helpful, because it provided me with a pool of potential students, as well as a time and place to lead the series. It is imperative that the workshop series be voluntary, but I thought the fact that we were offering the workshop during school hours, as opposed to asking students to give additional time outside class, might make participation less of a burden, and more favorable to students whose interest and/or experience in technology design was lower. Of the ten

[335] IRB 1489 Approved Protocol, "Critical Wearable Workshop Series," Kathleen McDermott, Spring 2016. Full protocol can be found in the appendix of this document.

students who joined, 60% rated themselves as having a slight or moderate ability to create new technology (Fig 8.1).

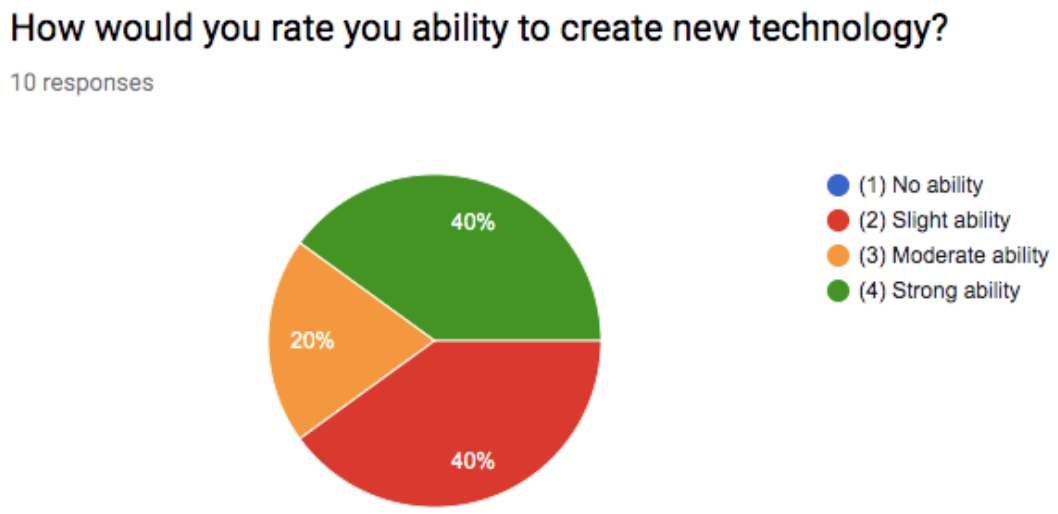

Figure 8.1: Wearables Workshop at Tech Valley High School, pre-workshop survey, Kathleen McDermott, 2016.

8.3.2 Workshop Execution

In this section, I will include my weekly lesson plan, as it was laid out in the IRB protocol, as well as excerpts from the research journal which I kept through-out the workshop process.

Lesson 1- Laying the Conceptual Groundwork (80 min)

- As a group we will have a critical technology discussion. Discuss our current relationship to technology. Watch some short sci-fi clips. Discuss their relevance to contemporary state.

- Exquisite Corpse game–this is a surrealist game where a paper is folded in three parts. Students draw a "head" and then pass the paper to the next student who draws a mid-section, and a third student draws the "legs." They can get creative (adding octopus legs for example), and when you unfold, the results are usually strange.
- Collage or drawing time–students come up with quick, speculative designs for wearable technology using drawing or collage.
- Discussion of creative work: Talk about the drawings, how they could be turned into real technology pieces. Brainstorm some sensors we might want if we were to make these projects.

Notes on Lesson 1:

The students first filled out their pre-workshop surveys and then I introduced the critical technology conversation by explaining the idea that some theorists believe that all humans are naturally cyborgs, due to our historically intimate relationship with tools.[336] I offered that I could be considered a cyborg because I wear contact lenses. I asked the students to introduce themselves, and list a piece of technology they rely on heavily, something that might make them a cyborg. The most common answer was smart phone, with a few other students citing their glasses or desktop computers. I then showed a slide with the statement, "The Future Affects the Past," with the follow-up questions, "In what ways are science fiction films correct or incorrect in their predictions of the future?" "Does science fiction affect the way we view technology?" I showed several short clips, including one from *The Jetsons*, *The Matrix*, and *Mad Max*. We spent some time discussing the premise of *The Matrix*, as some of the students felt the science in the film had been diluted. In a moment reminiscent of some of my experiences with students at RPI, the conversation became more about the scientific *plausibility* of the films than about the greater metaphors they were trying to make. I asked the students if any one the films had qualities they could see in our current moment, and the students saw few relationships, except for perhaps in *The Jetsons*. I personally

[336] Andy Clark, *Natural-Born Cyborgs* (New York: Oxford University Press, 2003).

see a lot of interesting parallels to contemporary issues in *Mad Max*, a world where gas and water have become valued above all other things, but perhaps showing a short clip wasn't the best way to communicate these issues, because the strong visual style is so dominating. One of the students cited the film *Wall-E*, which represents the humans of the future as completely immobile consumers of food and entertainment, motorizing their way around Mars on floating scooters. Many of the students agreed that *Wall-E*, seemed like the most accurate depiction of contemporary American life. (This is also a film they were likely to have seen as children, so they may have had more time to reflect on it). A thread I noticed in this conversation was that these students have grown up with screens present in their life in a much more apparent way than I did, though I am only 10-12 years older than they are. Following this thread, I mentioned the ideas of social theorist Sherry Turkle, who has alleged that young people show a reduction in empathy as compared to previous generations, which can be traced to their heavy engagement with digital media.[337] The students had an interesting response to this assertion, with some of them conceding that they could see the truth in it, but most of them expressing skepticism toward Turkle's measurement techniques. To paraphrase, the response was, "We have just as much empathy, we just show it in a different way."

The last conversation (that I have notes on) from that day was around the ethics of augmenting the body. I had showed them images earlier of Stelarc's "Third ear," as well as Oscar Pistorius's prosthetic legs. This brought up an interesting refrain that I have heard in other casual conversations, which is that body augmentation or modification is perceived as acceptable when someone has a medical need for it, such as in the case of Oscar Pistorius's amputated legs. Outside of the realm of necessity, prosthetic modifications make people uncomfortable. However, there

[337] Sherry Turkle, "Reclaiming Conversation," lecture, Union College, Schenectady, NY, February 25th 2016.

were a few students who posited, “If you can do it, why wouldn’t you?” This conversation and the varying perspectives of the students was very interesting, and I wish I had better documentation of it. I also would like to consider how I can guide the conversation to delve into questions more deeply. My memory of the conversation was that it felt a little rushed. Did I keep the pace quick because I was trying to fit too much in? Or was I responding to what I perceived as an impatience on their part to move on to technical lessons? In the future, I think it would be nice to include a writing unit to try to get a more detailed sense of the students’ perspectives. We also played Exquisite Corpse, though we didn’t have much time to discuss the results.

Lesson 2-Intro to Creative Circuit Design (80 min)

- Wire up LEDS in series and parallel using breadboards, resistors and batteries.
- Sewing Circuits with conductive thread and Lilypad: for their first wearable project, students sew lights to a piece of clothing. They should first draw their circuit design on paper, the challenge with sewing circuits is to avoid a short! Show example of Leah Buckley biker turn signal jacket. http://www.instructables.com/id/turn-signal-biking-jacket/

<u>Notes on Lesson 2:</u>

In our second lesson, we practiced making circuits with LEDs, breadboards and batteries, before moving on to attempt to create circuits through sewing. The students were very confident in the first portion of the lesson and so I thought they were well-equipped to begin sewing their circuits, but they experienced a lot of difficulty with this part. If I do this lesson again, I will give a demonstration on how to sew first, as well as ask students to use a light pencil to mark their circuit on the fabric. We drew our circuits on paper before we started, but moving to fabric was much more complex, because some students were using both the front and back, (for example, sewing the battery to the back side in order to hide it, and the lights to the front.) Further, many

students didn't understand the concept of making stitches, and tried to use one long stitch to bridge between components. This meant their components were not securely attached, and the conductive thread hung loosely, and easily shorted. I had been keen on introducing this lesson early, so that each student could have a visible result of their work, but it might be better to push it to the third lesson so we have more time to understand circuits.

Tthis lesson was eye-opening because the students grasped the technical aspects quickly, but struggled with the craft elements. I have since seen this issue replicated in other ways while teaching wearables. It may not be too difficult to have students plan and test a project on a breadboard, but designing a way to fit a system into the body in a stable way is more challenging, and relies on a broader array of skills for working in 3-D, including craft skills. For this reason, I think artists and designers are actually quite well-suited to problem-solving unique wearable applications. I later iterated on how I delivered the content of the sewing circuits workshop which has greatly improved it. I first have students test the sewable LEDs with alligator clips, then I have them draw their design on paper. I introduce the concept of making stitches, for those who don't know how to sew. I emphasize the fact that the thread is not insulated, so in some ways it is more challenging than working with regular wire. We talk a lot about what constitutes a short. I also offer students the challenge of interrupting their circuit in an interesting way, to create a switch. I made an example where I have sewed from the ground terminal of a battery to the middle of my shirt sleeve. Then I cut the thread. I started a new line, further up my bicep, and sewed to the ground terminal of the LEDS. I sewed the positive connections between the LEDS and the battery terminal normally with no interruption. The interruption on the ground line means the lights will not turn on. But if I flex my muscle, contracting my arm, the ground line will be completed, allowing the lights to turn on only when I am flexing (fig 8.2). I have found this to be a good

example of how the design and layout of the circuit creates a kind of responsiveness, that isn't dependent on programming. In fact, I no longer use a microcontroller when doing this lesson, I simply use a coincell battery holder and LEDs. I have since had much more success doing this lesson with beginners, and have given it at Hamilton College,[338] The Tides Institute and Museum of Art,[339] and The Textile Arts Center,[340] where student designs have included a glove that lights up when the wearer gives the thumbs-up sign and a bra that lights up when the wearer squeezes their breasts together. The ideal time to complete this lesson is three hours.

Lesson 3-Intro to designing with Arduino (80 min)

- Program lights to turn on based on sensor data. Students first learn to program basic blink sketch. They then learn to have lights turn on based on data from a photocell transistor (which can sense ambient light levels.)
- Program motors to turn on based on sensor data. Students receive quick overview of working with servo motors, and modify code created earlier to include motors.
- Troubleshooting. Students learn to troubleshoot their code and wiring. Instructor demonstrates how to access information from online forums, work with example code.
- AutoFilter re-design: Students make their own version of The AutoFilter (a previous project by the artist) http://kthartic.com/index.php?/class/urban-armor/ Draw a design that could use this system of motors responding to one of the sensors provided.

[338] "Inventions for Dissent: Crafting alternative future landscapes with DIY wearable tech." *Keynote presentation and workshop* at Making Community at Hamilton College, Hamilton, NY, November 11, 2016.
[339] "DIY Wearable Futures," Workshop at Tides Institute and Museum of Art, Eastport, ME, August 9, 2016.
[340] "DIY Light-Up Badges for Protest," Workshop at Textile Arts Center, New York, NY, Sept. 29, 2018.

Figure 8.2: Still from video showing LEDs light-up when flexing. Kathleen McDermott, 2016.

Notes on Lesson 3:

After our second lesson on sewing circuits we had a skill-building lesson with the Arduino. Again it felt a bit rushed but we did complete the technical tasks I'd laid out, which were to first turn on a light with the Arduino, followed by controlling motors, and finally, controlling motors with a sensor. The reason why I wanted to get them started with motors early was because I think motors are one of the most fun tools to work with, in respect to thinking about wearable sculpture. My first Urban Armor piece, *Urban Armor #1: The AutoFilter*, is very simple technically, it uses a pollution sensor to control two motors, which move a scarf up and down. I asked the students to think of what kind of project they would make with two motors and a sensor, (any sensor). This

seemed promising, and the students had an interesting brainstorm, but we ran out of time to finish out this lesson.

Lesson 4-Plan and Start Critical Wearable Projects (80 min)

- Brainstorm in teams. Students discuss ideas in small groups (probably two groups of five).
- Group discussion and feasibility. With the class we talk about how we could accomplish these projects, viability, supplies needed.
- Break up workflow. Students discuss how they can break their project into smaller tasks, and divide the work among the group. Start working!
- If necessary, finish any of the Arduino lesson from previous week

Notes on Lesson 4:

In the fourth lesson we began to brainstorm for our final wearable projects. After speaking about this with Professor Miller, I decided to have the students organize around common interests. Using a white board, we generated topics that could be considered relevant to the theme of "stereotypes," and the three main themes that emerged were an interest in religious discrimination, mental health issues, and sexual violence. Within their groups, I asked the students to start thinking of ideas for a potential wearable piece and then present these to the class. If I were to do this again, I think I would generate a list of points to have on the board or projector that the students could refer to. These might be questions such as, "How can this project be refined to create opportunities for meaningful conversations to occur?" The group that focused on religion became interested in the idea of sewing conductive thread into the shoulders of a shirt to act as buttons that might read when the wearer makes the sign of the cross. They were a little stuck in regards to what the sign of the cross function might trigger. The sexual violence group was very interested in the idea of

using a limit switch (which acts like a push button but has a long arm that enacts the switch), in shoes to allow the wearer to click their heels and set off some kind of alarm. Like the first group, they had thought of a creative implementation of the technology, but were struggling to refine the conceptual aspects of their piece. The third group was working in a reverse order, they had a lot of interesting concepts around the idea that people with mental health issues might suffer from the invisibility of their issues. To paraphrase one participant, "You might think someone is being a jerk, but they could actually be suffering from an anxiety attack." Their ideas included making a device to swaddle the wearer, to shoot air at bystanders, or to trigger some kind of soothing audio.

Lesson 5- Working Session: Troubleshoot and Feedback (80 min)

- Working session: Students spend the bulk of the session working in groups, with the goal being to get a breadboard version working of the electronics, and the structure of the object started. Instructor offers troubleshooting help.
- Feedback: Students show the group what they have so far and receive feedback from other groups, they can think about design decisions in terms of how it looks, as well as technical decisions.

Lesson 6-Working Session: Troubleshoot, PCB soldering, (80 min)

- Working Session: Students continue to work in teams.
- Instructor offers troubleshooting help.
- PCB Soldering: If students have a breadboard version working, we can discuss how to plan out a PCB circuit and solder it, to make the project more permanent and more compact.

<u>Notes on Lesson 5 and 6:</u>

In the fifth lesson I asked the students to sketch their project in a way that might make the function obvious to others. I think I could have showed them more examples of project sketches and also written down the requirements that each sketch should meet so that the sketches could

have served more to force the students to work through their conceptual issues. Thinking through this now, it seems like in many of the lessons I could explicitly state certain requirements that might help the students be more successful.

For the rest of the fifth and sixth lesson the students began production, and at the end of each class the groups updated the class on what they were working on. The religious group has updated their concept so that the wearable plays a religious song on a loop and will not stop until the wearer makes the sign of the cross. I think this idea is getting stronger, though I have asked them to more seriously consider the ways in which the project would be different depending on what song they play. The sexual violence group has gotten a little side tracked by the technical production. This group has had less prior experience using the Arduino, so I might think of this group as a good preview of what it might be like to work with a group of students from a less technical high school. They are very focused on solving technical problems. I think I need to find a way to help them that doesn't involve me sitting down and writing out the code for them. In my lesson plan, I stated that I was going to give a lesson on troubleshooting code, which includes tips for searching internet forums, and process of elimination when a component breaks down. I forgot to do that, so maybe I can introduce that in the next lesson. (One thing that makes this difficult is that we are in a lab with no projector so they have to look at my small laptop screen, which isn't ideal.) Another thing I might have each group do is make a list of what they have to accomplish for the piece to be finished so they can prioritize tasks.

The third group has a very interesting dynamic, because there is one student who feels strongly about social issues, and another student who feels strongly about programming. Some of the issues the first student finds conceptually interesting, the second student does not find interesting technically. They seem to be working through this, though, and are settling on the idea

of retrofitting a hooded sweatshirt with motors, so that the wearer can move up a hood to cover their ears. I had suggested using a simple sound sensor to trigger the hood movement, but the student who wants to be technically challenged has decided he wants to write an app to look for specific types of audio, using the embedded sensors in his phone.

Lessons 7 and 8:

- Not stipulated in IRB, but we continued to work on the student projects during class, and we also began talking about how students could document and present their work.

Notes on lessons 7 and 8:

Although there are things I could improve about the series– especially to better reach my objective of learning more about the participants' relationship to technology– the atmosphere of the classes has been very fun, and they all seem to be enjoying it. One student has said repeatedly, "I'm an engineer now!" He is being facetious but I do think it's been fun for him to gain knowledge in an area he didn't have access to earlier, (especially in a school like TVHS, where the students with technical knowledge seem to also be imbued with a certain social cache). One thing I've thought about is whether I could have asked the students to more vigorously research the social issue they wanted to engage with. Perhaps I could have done this from an art perspective and less from a social science perspective. Critical observation is a skill that many artists incorporate into their practice, so perhaps I could have asked students to think more critically about the topic they had chosen to focus on. For example, "What tools or technologies can be said to be currently utilized in regards to this issue?" I did ask the students to research precedents for their project, but framing this research from the lens of critical observation might

have pushed them further. Since the series is not over yet, I will also try to see if I can implement some of the changes I have been laying out in my notes.

One of the ideas I am interested in, though haven't fully articulated yet, is the idea that there can be other models for a future of technically-engaged humans, beyond the narratives that are most commonly eschewed, which are either the techno-optimist model of humans gaining total control over their environments through the power of sheer logic, or the dystopian predictions of technology run amuck and subjugating human will. This concept is important to me in respect to the idea that certain types of wearable technology design treat the human body and mind as something to be optimized, primarily in order to create better workers and consumers.

An aspect of Paolo Friere's theory that I have found helpful when considering the usefulness of this workshop endeavor, has been the idea that creativity can help produce new realities, "If humankind produces social reality (which in the "inversion of the praxis" turns back upon them and conditions them), then transforming that reality is an historical task, a task for humanity,"[341] Friere reminds us of the importance of big-picture philosophy. The type of creative thought that goes into solving a very particular problem, such as how to make a wheel spin, is very different than the creative thought that assesses the role of the wheel in a culture. It may be useful for me to consider a lesson or toolset that can help drive that point home to my students. Maybe the goal of the series should not be to make students feel they can be as good at technology design as engineers, but to help them see why all citizens should have a role in assessing the value, ethicality, and use of the tools we develop.

[341] Paolo Friere, *Pedagogy of the Oppressed,* trans. Myra Bergman Ramos (New York: Continuum, 2005), 51.

8.3.3 Wearables Workshop I Conclusion

As my notes from the workshop show, I was consistently conflicted throughout the series on how to balance the conceptual content with the technical content. I also had not fully arrived at the absurdist electronics method yet, at the time that I gave this workshop. I had established the desire to break out of the utopia/dystopia dichotomy, but I hadn't arrived at absurdity or humor as a possible solution. Consequently, many of my notes reflect a concern that I should add more structure to the workshop, to privilege the conceptual conversations I wished to have with students. However, not noted in the journal, is my instinct that it might be difficult or awkward to force those conversations through some kind of rigid framework. The students may not agree with my opinions and I do not want to force my perspective on them. So, while my research notes are fairly fraught with concern that I had failed to inject enough critical framing, in hindsight I can recognize that the workshop did succeed in creating an atmosphere of fun and experimentation. The students were very motivated to complete their projects and worked on them outside of class time. Each of the three groups did ultimately complete a fully functional prototype, and one group created a narrative video. The prototypes included a garment that played the song "Jesus loves me," repeatedly until the wearer made the sign of the cross (fig 8.3), a pair of red shoes titled Dorothy 2.0 that emitted a loud sound and lit-up when the wearer clicked her heels (fig 8.4), and a sweatshirt with a motorized hood, "The Ignoromatic," which allows the wearer to isolate herself in stressful, loud situations (fig 8.5). This was designed for a student who was sensitive to auditory feedback.

Figure 8.3: "Pray Anytime." Concept Sketch by students in Critical Wearables Workshop, 2016.

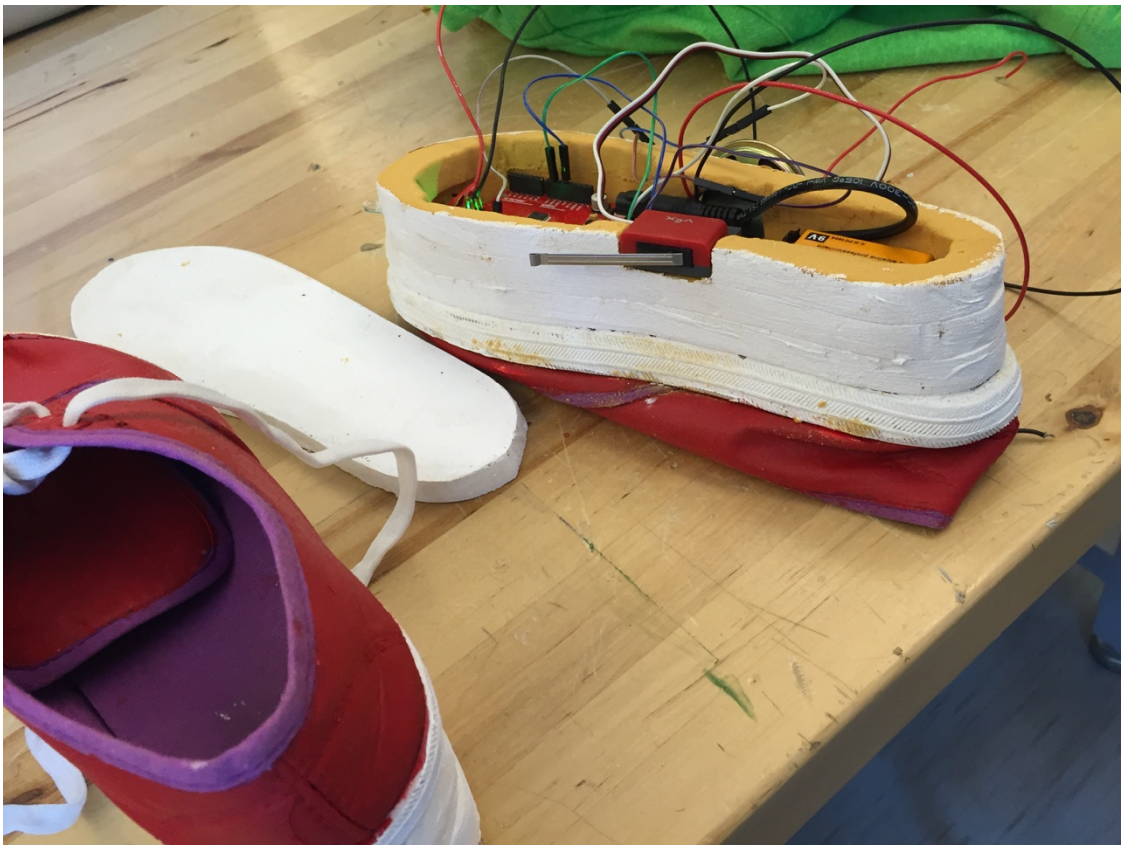

Figure 8.4: "Dorothy 2.0." Image of work-in-progress by students in Critical Wearables Workshop, 2016.

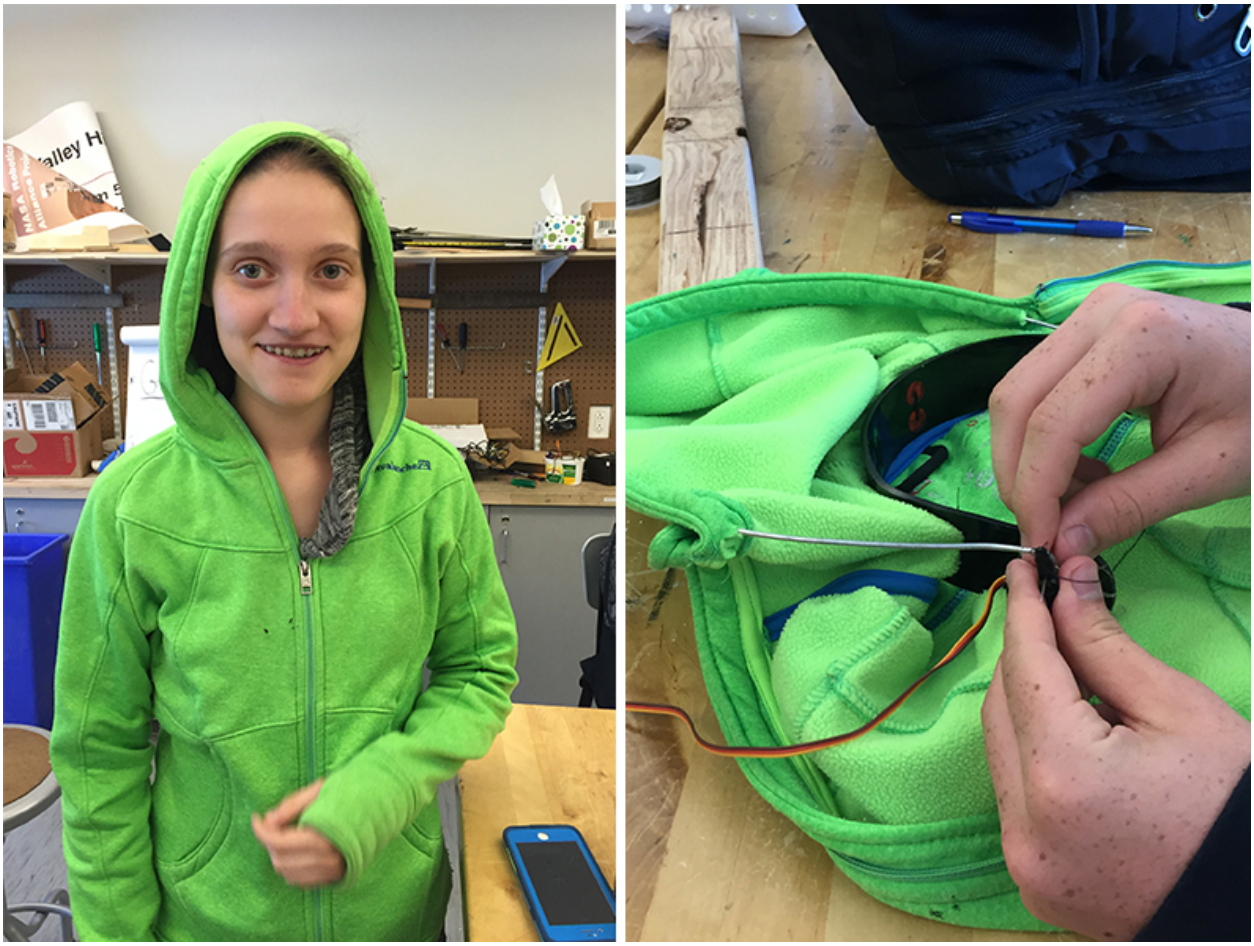

Figure 8.5: "Ignoromatic." Image of work-in-progress by students in Critical Wearables Workshop, 2016.

8.4 Critical Wearables Workshop II

8.4.1 Planning and Design

I considered the first critical wearables workshop to be pretty successful, however, I recognized that its success was contingent on certain conditions, such as having the same group of students for multiple, simultaneous lessons. From my prior work in afterschool programs and other

educational outreach initiatives, I was aware that supplemental programs offered outside the school day should not assume that students will regularly attend. So, I wanted to develop a version of the critical wearables workshop in which each lesson could stand alone, and that students could drop in or out week to week. I wanted to rely less on microcontrollers, to help reduce the cost of the workshop series and to make it more suitable to slightly younger learners. For this version of the workshop, I again received generous funding support from LESA at RPI. I emailed the afterschool coordinator at Troy Middle School, a contact I found on their website, and I was surprised by how open she was to allowing me develop an afterschool module. She explained to me that they offered their afterschool programming in six week units, and that students had the option to sign up for different activities each cycle. She asked me to write a short description of the activity that she could share with students, and then students signed up voluntarily. Attendance varied from 5–8 students week to week.

8.4.2 Execution and Reflections

The full lesson plan for this workshop series can be found in the appendix of this document.[342] In summary, the six lessons I planned were:

- Lesson 1- Conceptual Groundwork + Conductive thread Gloves
- Lesson 2- Sewing Circuits
- Lesson 3- Soft Button Light-up bracelets. (Pressure pad using conductive fabric)
- Lesson 4- Making "smart" lights using a transistor, photocell, and an LED
- Lesson 5- Making "smart" robots using a transistor, photocell, and motor.
- Lesson 6- Stretch sensor + intro to Arduino

[342] IRB 1549 Approved Protocol, "Critical Wearable Workshop 2nd Iteration," Kathleen McDermott, Fall 2016. Full protocol can be found in the appendix of this document.

One important difference in working with younger students, was that the challenges I'd encountered at the high school, regarding students' ability to sew and engage in craft skills, were further amplified. Some students struggled to tie knots and use scissors. Consequently, lessons took longer than I'd planned and often extended across multiple sessions. Lesson 1, which was intended to be very brief and required students to sew conductive thread into gloves, in order to make gloves that could be used with a touch screen, went particularly badly, because it is very hard for a beginner to sew to the pads of gloves without accidentally sewing the fingers shut. I should have anticipated that.

Lesson 2, the sewing circuits lesson, went better, though it required a lot of time. Several students thought to sew lights into their backpacks, because by the time the after-school program ended they were walking home in the dark (fig 8.6). Another student sewed LEDs into her scarf in the shape of the Big Dipper, and sewed her thread in such a way that the circuit would only be completed when the scarf was crossed around her neck. Another student sewed blue lights inside his sweatshirt, as part of a quasi-fantastical idea that if he was feeling stressed, he could turn on these lights to "cool down,"(fig: 8.7). I think the fact that I had delivered this lesson in the previous workshop iteration, and had time to reflect on it, contributed to the success of this lesson.

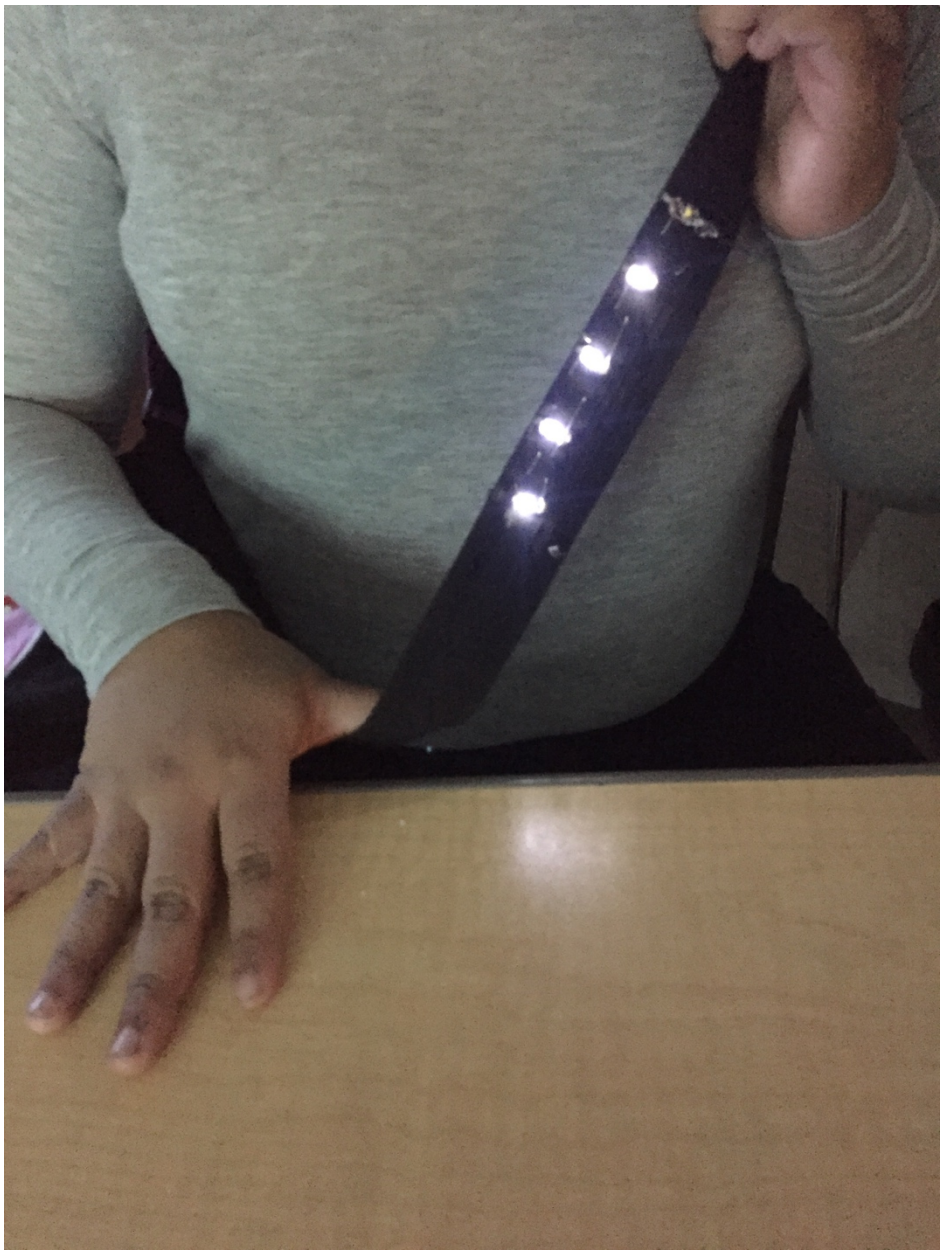

Figure 8.6: Image of sewable LEDS on a messenger bag by student in Critical Wearables Workshop II, 2016.

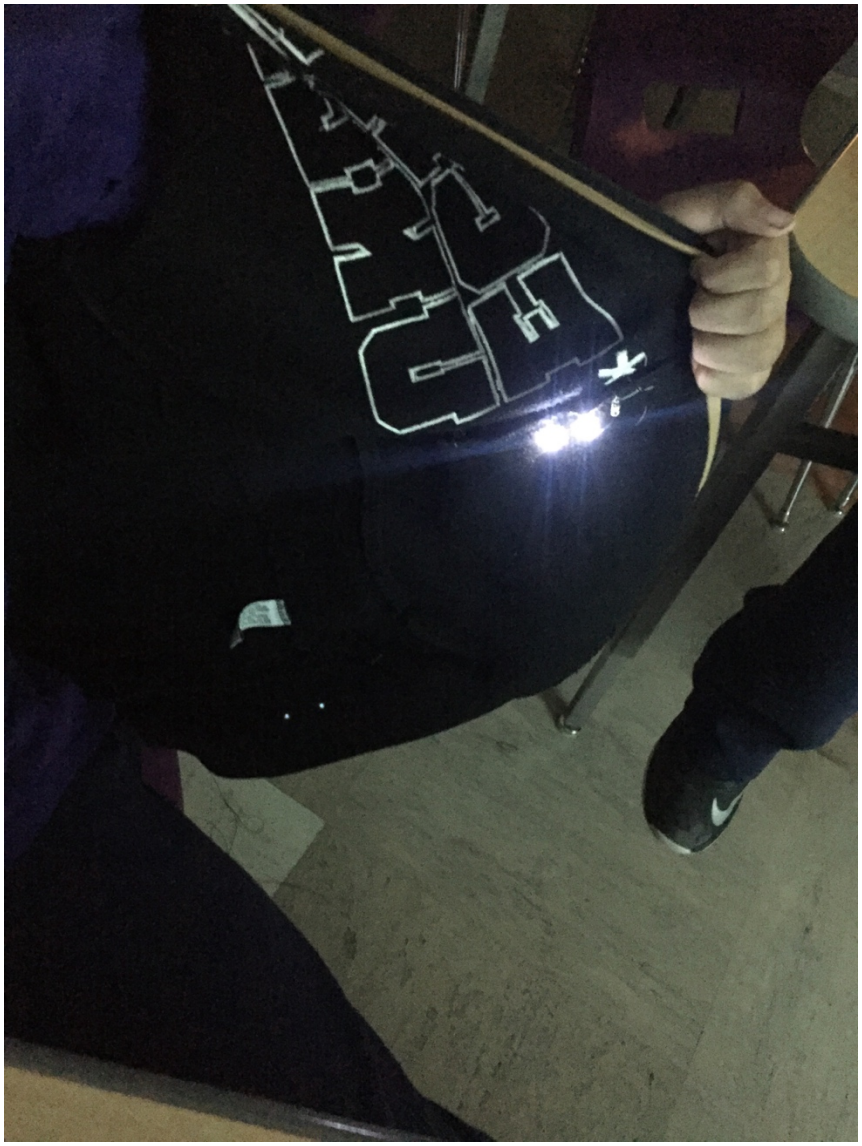

Figure 8.7: "Cool down jacket," Image of sewable LEDS project by student in Critical Wearables Workshop II, 2016.

Lesson 3 included a fabric-based button, in which students utilized conductive fabric to complete a circuit (fig 8.8). This project was again challenging because of the degree to which students needed to sew. I also hadn't thoroughly considered the design applications. I didn't want to use a microcontroller, so the design consisted of a fabric based button, that turned on an LED

directly. I was thinking these could become fabric flashlights. But the question of where the light and battery should sit in relation to the fabric button and how the whole thing should be secured, was actually quite a design challenge. Like lesson 2, this also required a lot of time to complete.

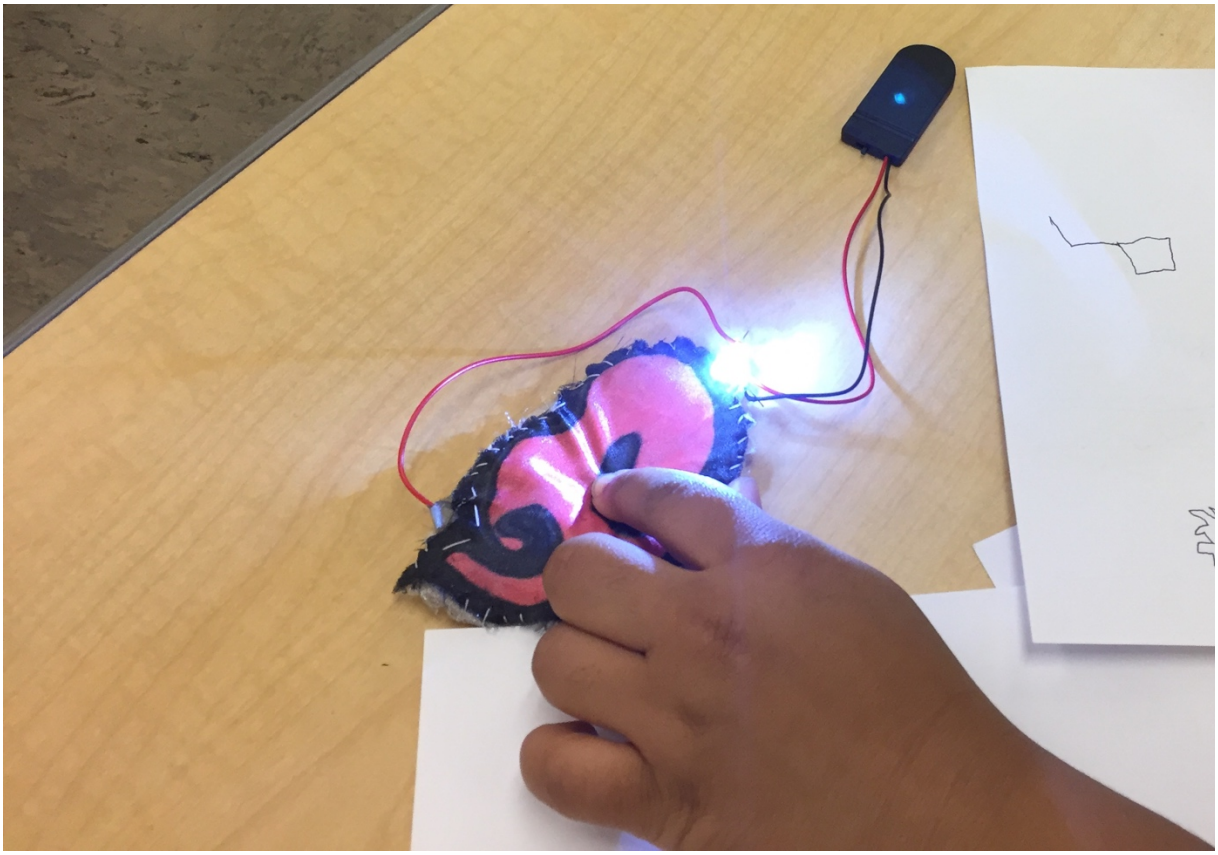

Figure 8.8: Image of fabric button project by student in Critical Wearables Workshop II, 2016.

Lesson 4 used a simple photocell and transistor-based circuit to turn on an LED in low light situations. Although the students were able to make this work on a breadboard, it was too challenging to ask them to solder so we were limited in how they could implement the breadboard-based designs. I also think introducing the breadboard was a new concept that threw students off

somewhat, and we would've been better off sticking with fabric-based materials that we'd been using throughout. We did not make it to lesson 5 and 6.

Although the different projects were unrelated, most students maintained consistent attendance across the six-week workshop and were therefore able to build their circuit design and production knowledge over time. All students expressed an interest in participating in the workshop again, if it were to be offered. After completing the workshop, 71.4% of students reported a very strong interest in technology design (fig 8.9), compared to 28.6% in the pre-workshop survey (6.10). Although, the pre-workshop survey had 9 responses, while the post survey had only 7, which could skew the results somewhat more positively. Keeping that in mind, the surveys showed that 86% of participants rated technology as very important to their life in the post-survey, as opposed to 55.6% in pre-survey. 85.7% rated design as an important aspect of technology in the post-survey, as opposed to 22% in the pre-survey. 85.7% of students self-reported a moderate ability to create new technology in the post-survey, as opposed to 22.2% in the pre-survey.[343] While the student response through the surveys was encouraging, my general experience of this workshop series was more stressful than the first iteration. A difficulty with completing circuit-based lessons with younger learners, is that there is a very clear end goal: the circuit should work. And although there may be open-ended aspects of the design, most students will not be satisfied by a circuit that does not work, so there is a possibility to set them up for a frustrating experience. I can see how this kind of observation may have led to the development of tools such as Littlebits,[344] which are designed to be connected and played with easily, and have a low rate of failure.

[343] For full pre and post-workshop surveys, please see appendix.
[344] Littlebits, accessed May 10, 2019, https://littlebits.com/.

I think another possible model for this type of workshop, that could possibly be executed with a small group of young people, would be to work as a class to design one or two absurdist electronics objects. Then, the instructor could break the project into parts and have students work on different aspects of it. This might allow students to have more freedom in the design phase, and would also reduce the pressure of success/failure that comes from working on an individual circuit-design project. In hindsight, the group project element of the first workshop iteration was really successful in reducing the anxiety/pressure that often surrounds technical lessons.

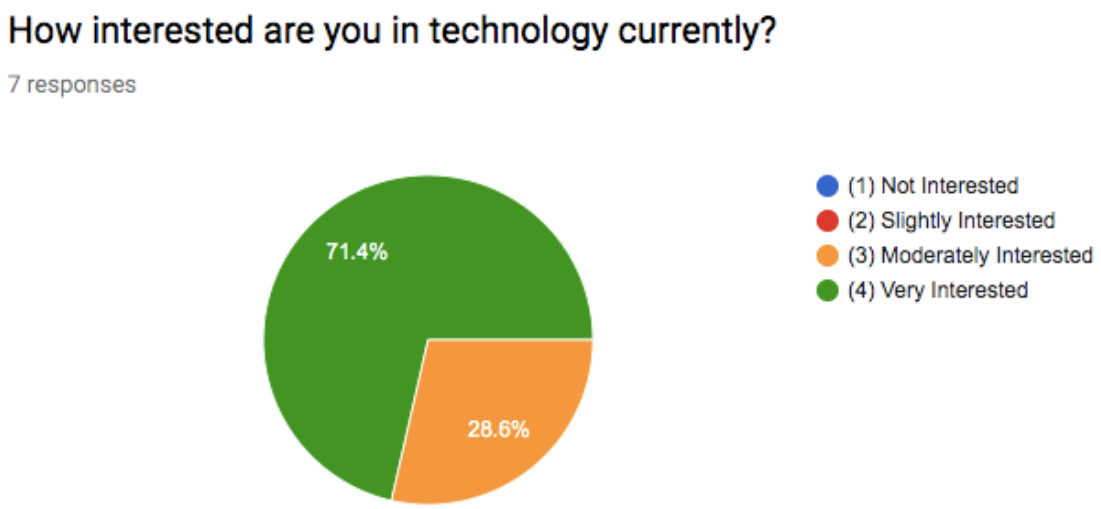

Figure 8.9: Wearables Workshop at Troy Middle School, post-workshop survey, Kathleen McDermott, 2016.

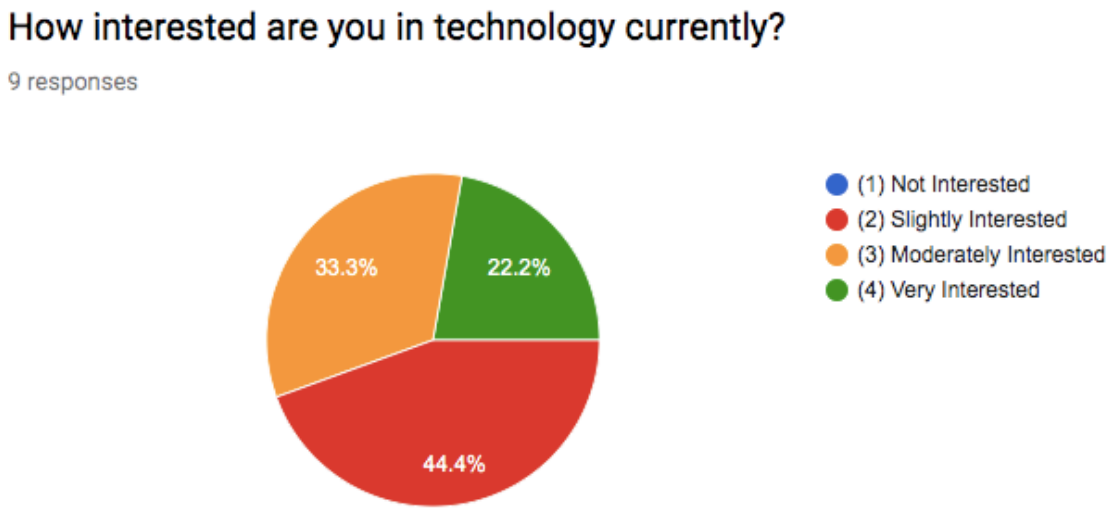

Figure 8.10: Wearables Workshop at Troy Middle School, pre-workshop survey, Kathleen McDermott, 2016.

8.5 Other Workshops: Sunbots and Machines for Care

8.5.1 Sunbots Workshop

The Sunbots Workshop[345] took a different format than the Critical Wearables Workshops, because it was based around the idea of collaboratively producing a pre-defined piece. My goal with this workshop was to explore the idea of making multiples of the Sunbot, to see how they might appear to behave differently in a group, and to see the effects of outsourcing the design of the robot structures to workshop participants.

[345] IRB 1549 Approved Protocol, "Critical Robotics Workshop," Kathleen McDermott, Spring 2018. This protocol was a modified version of the Critical Wearables II Protocol, and received an expedited review. Full protocol can be found in the appendix of this document.

In preparation, I designed and fabricated PCBs which laid out the traces of the Sunbot circuit. Reflecting on many of my past workshop experiences, where time was always an issue, I decided that I wanted the design of the robot body to be the focus of this three-hour workshop, and that there would not be enough time to have students solder components. Further, soldering components on circuit board that is already laid out may be a useful way to learn more about hardware fabrication, but it is not a very creative endeavor, and I wanted to privilege time for experimentation. Therefore, I pre-soldered all of the components onto 12 circuit boards, across the course of several days. I used screw terminals and jumper wires, to allow the circuit boards to be disconnected from larger components, such as the wheels, photocells, IR emitters and receivers, ultrasonic sensor, and batteries.

In the beginning of the workshop, held at Open Source Gallery in Brooklyn, I demonstrated how a fully assembled Sunbot behaved. Then I distributed circuit boards and showed participants how the copper traces connected components together on the boards. I asked the students to plug in the wheels, sensors, and batteries, to check that their boards functioned properly. This was an important step in helping participants understand the functionality of the different components. Then, participants designed bodies to house the components of the robots, primarily utilizing recycled materials that had been collected by Open Source Gallery (fig 8.11). The materials utilized included a cassette tape player, a juice bottle, a printer, a salad container, a milk carton and a tin can. Most of the participants were able to fully assemble their robots to a degree which allowed them to test their behavior. The students using the tape cassette and printer experienced the most challenges in assembly, because they were using harder plastic, that was difficult to cut through and modify. Throughout the workshop, we talked about robot functionality. I was concerned that participants would be disappointed that they could not take their finished robots

home, due to the high cost of the components, which I wished to re-use, but they appeared unbothered. I later produced a video of all of the robots together, which I have outlined in the previous chapter, and which I shared with participants. Based on anecdotal feedback, this was a successful workshop, because the scope was limited and clear, and participants were able to test their robots and make modifications to their design, such as placement of the wheels, in real-time.

A precursor to this workshop had been a modification of "bristle bots," a lesson I've seen online for making tiny robots out of vibration motors and parts of toothbrushes. I have conducted a modified version of the bristle bots workshop at the Tides Institute and Museum of Art in Maine, however, like some of my earlier experiences giving workshops at Troy Middle School, I found that craft skills were the biggest barrier to entry with this workshop. Vibration motors tend to have very tiny, fragile wires, and it can be quite difficult for a beginner to twist these wires to longer jumper wires. When working with young people, I have found the best way to get around this issue, is to have many adults in the room to help, and to prep difficult parts in advance. Soldering jumper wires with male/female connectors to the motor terminals is also a simple way to make the motors easier for young students to work with.

Figure 8.11: Sunbots Workshop at Open Source Gallery, Kathleen McDermott, 2018.

8.5.2 Machines for Care

The experience working with recycled materials in the Sunbots workshop, and my continued experience of trying to consider interesting electronics workshops with a reasonable supply cost, led me to consider more possibilities for working with e-waste. My thinking in this area was also influenced by making *The Power Suit* (chapter 6) which utilizes recycled hairdryers.

I was invited to show some work in an exhibition on care[346] and the curator asked me to also propose a workshop. I proposed to teach participants how to take apart old electronics in order

[346] *Three Acts, Three Scenes: Your Care, My Care, Careful Care,* curated by Natalie Fleming and Conor Moynihan, (Brooklyn, NY: Kunstraum Gallery LLC, 2018).

to access the motors, to adapt them to work on battery power, and to repurpose them to turn them into machines for care, or gentleness. The primary technical lesson in this workshop, consisted of showing participants how to look for seams and screws in consumer electronics. I think this was useful, because there are many ways in which we become blind to the objects we use a lot. If you've never though to open up a hairdryer, you may not realize that it is even a possibility. One participant had brought a very old punch clock, which was made of metal, and which we could not figure out how to open, which was a bit disappointing. But the more contemporary electronic junk, including plastic children's toys, an automated tie rack and a children's pottery wheel, were opened successfully. I then showed participants how to remove any circuitry attached to their motors, and to test their motors on a DC power supply. We had battery packs as well as AC/DC converters which plugged into the wall. I had brought 6V and 12V supplies, but we definitely could have used a 3V supply, for the smaller hobby motors and toys.

Myself and the curators had brought additional craft supplies, such as streamers, pipe cleaners and noisemakers, and we asked participants to make some kind of a Frankenstein design, to modify the purpose of their original machine and make it a machine for care. Most of the designs consisted of hot gluing light weight elements and attaching them to motor shafts, to create motorized brushes or decorations. One participant was able to modify a gear set from a toy and create a kind of automatic hand waver. For the most part, the results were experimental, and I think the primary takeaway for participants was the idea that you can consider consumer electronics and junk as creative materials. Most of the participants were artists, and I think they appreciated this aspect of the workshop.

I subsequently developed a more involved version of this workshop called junk hacking, in which participants access motors in junk and then learn how to control DC motors through a

transistor circuit and an Arduino. Then I show how to incorporate a sound sensor, so we can turn any junk into a clap-on, clap-off device. The novel element of learning how to take consumer electronics and make them sensor-activated, has made this workshop consistently successful. However, I have so far always run out of time for seriously considering applications for the designs. I liked how the machines for care workshop, although less-complex and less "useful," than some of the other lessons I've led, left space for a lot of creative material exploration.

8.6 Conclusion

The experience of giving the Critical Wearables Workshop and its subsequent variations, was extremely useful in bringing to light challenging parts of particular project tutorials, that would not have been obvious to me when I was writing out the lesson plans. Sewing, twisting wires, soldering, and fitting components into irregular structures such as plastic junk and fabric, were all challenging aspects of the lessons, particularly for young learners. Generally speaking, the lessons were successful in having a manageable technical component that learners seemed to comprehend and enjoy. For most of the workshops, I spent more time considering how I would break down and teach the technical elements, than I did for the creative or craft elements. This is an aspect of the research that I could definitely consider further and improve. Is it possible to consider teaching absurdist electronics, in a way that incorporates absurdity into the lesson plan? What are other methods for helping students consider their projects holistically, to not become disproportionately focused on the electronics, but to also consider the other materials they are working with, with equal care. A useful precedent can be found in Hannah Perner-Wilson's "Kit of No Parts,"[347]

[347] Hannah Perner-Wilson, "A Kit of No Parts″ (Master's thesis, Massachusetts Institute of Technology, 2011).

which consists of a library of experiments using textile components and electronics, such as a speaker made out of conductive thread. Perner-Wilson has made dozens of e-textile interventions available on her website, like ingredients, and it is up to the learner to assemble these ingredients into a recipe. An equivalent "cookbook," for absurdist electronics, would need to include elements which demonstrate ways to seed electronics design with humor, shock, chance, and contradiction.

CONCLUSION

Through the process of engaging with the breadth of philosophical literature surrounding the relationship between humans and technology, I've come to see the value of creative engagement with this conversation in a different light. Increasingly, "technology," is a term so broad and pervasive as to have little meaning. It influences and sometimes dominates our economy and our personal lives. What was once perhaps a fringe pursuit has become the topic of constant mainstream conversation and analysis. It plays out in the media, in academia, in fiction, and in domestic spaces. And although there remains a persistent sense that the future of many is decided by a privileged few—lawmakers, select designers, the very rich—and this is likely true, dialogue is one way in which a greater number of people may have a chance to impact broader decisions about the way the future is designed. What I have proposed in this dissertation is one small, strange, additional way to participate in a much larger dialogue.

Within my practice, I don't think the absurdist electronics framing has greatly changed the type of work I make. However, I think it has changed the way I understand the role of this work. Where I was previously attempting to avoid participating in conversations regarding the future of technology, when invited, because I felt as an artist, this was not my territory or area of expertise, I now see a role for creative input in cross-disciplinary conversation. There is always a level of translation when speaking across disciplines, but that is to be expected.

The process of applying and especially reflecting on the absurdist electronics method, has also led me to see its shortcomings. There are several areas where the thinking could be developed further. From a practical perspective, there is an issue of sustainability present in the Making and DIY community. How can working with electronic hardware become a sustainable practice? One

potential method is through re-use and modification of e-waste. Another method may be to identify manufacturers that have environmentally-friendly production practices. In my own work, I often purchase components as cheaply as possible, but this may mean they were produced through practices that were exploitative of labor, the environment, or both. Another issue with DIY practices, is the question of accessibility. Informal feedback from people who engage with my web content has led me believe that the tutorials are difficult for beginners. How can I simplify them, to make them more accessible for a broader range of skill-levels? And similar to some of the questions which arose in the Workshops chapter, how can I seed the tutorials with critical framing? This is a project I am beginning to investigate in my new position, at NYU, with a group undergraduate researchers.

Across the case studies, the Sunbot chapter stands out as being the most markedly different from the other chapters, because it uses a non-human body. There are many issues which can be explored in greater depth here, but especially the question of the plants' agency. Most recently, I have been reading *The Secret Life of Plants*[348] which discusses research on plants' ability to communicate with each other through chemical signaling. Reconsidering the design of the design of the Sunbots through a more plant-focused lens, is also a project I am continuing to investigate with undergraduate researchers at NYU, and I suspect will continue to occupy my future work.

Other areas which interest me for continued investigation with the absurdist electronics method, include the internet of things (IoT), the smart home, and domestic robotics. Similarly to how the proximity between technology and the body led to my interest in critically considering

[348] Peter Tompkins and Christopher Bird, *The Secret Life of Plants* (New York: Harper and Row), 1973.

the design of wearable electronics, the intimate role domestic electronics may play in home-life, warrants critical consideration of the affective quality of these objects.

Perhaps the largest un-resolved question in the dissertation, is whether it is possible to incorporate elements of Dada into a replicable method, or whether this runs counter to a fundamental value of Dada, which is negation. These questions almost certainly contributed to the transition from Dada into Surrealism, as artists who wished to consider ideas with more sincerity may have felt limited by the Dada value of negation, or valueless-ness. I have attempted to address these issues in chapter 2, by citing theorists who point to the productive qualities of Dada negation, as well as practitioners who have selectively applied elements of Dada without attempting to entirely re-boot or replicate the movement. Nonetheless, in a moment where the logic and reason inherent to science are sometimes questioned as a tactic for sowing mis-information, the politics of applying absurdity to technology design could be called into question. For this reason, it is necessary to state my belief that it is possible to constructively question how commercial interests impact the fields of science and technology, without questioning the validity of scientific institutions, or science as a whole. As Valentino Braitenberg has said,

> This is an exercise in fiction science, or science fiction. Not for amusement: science fiction in the service of science.
>
> Or just science, if you agree that fiction is part of it, always was and always will be as long as our brains are only miniscule fragments of the universe, much too small to hold the facts of the world but not too idle to speculate about them.[349]

[349] Valentino Braitenberg, *Vehicles: Experiments in Synthetic Psychology* (Cambridge, MA: MIT Press, 2000), 1.

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APPENDICES

A. IRB 1489 Approved Protocol 032516

Title of Proposal: Critical Wearable Workshop Series (Pilot)

Researcher: Kathleen M McDermott

Objective: The objective of the workshop series is for the artist to share her work with a larger community, and to make a collaborative artwork with students. The artist is currently working on a series of wearable electronics that playfully address social issues, this project is called *Urban Armor*. To create the wearable tech pieces the artist uses exclusively open-source, DIY technology, and she shares the tutorials for the objects she makes online. Her work with DIY technology has lead her to think more critically about the role of technology in identity formation, as well as issues of lack of diversity in technological design.

Kathleen aims to expand her art practice to include a larger group of people, so that the artwork might be more inclusive, and the investigation into the role of technology in contemporary life might be more meaningful. The goal of the proposal is to develop a workshop series that will facilitate a group of Seniors at Tech Valley High School in Albany to create a unique wearable technology piece, of interest to them. The students who choose to participate will do so during their Literature class, where the teacher has asked that they investigate issues of "stereotypes." McDermott will aim to help the students use the technology in a way that helps them creatively investigate this topic.

Methods: McDermott has visited several schools to gauge interest in the project, and has decided to work with Tech Valley High School. Lana Hower, a literature teacher there, has agreed to allow interested students, (ideally no more than 10), to participate in the workshop during her class time, as part of their senior project. McDermott has presented a summary of the workshop to the class, so that they can get an idea of the topics covered, and they are free to decide whether they would like to join.

The workshop will consist of 80 minute sessions, once a week, for eight sessions. The workshop will include creative lessons and brainstorming, designed to help students think of technology as a potentially creative tool, followed by skill-building workshops, which will help students understand the basic concepts of circuit design, and coding and wiring the Arduino for control of inputs and outputs. Finally, there will be several sessions dedicated to designing a wearable technology piece that will address a social issue of interest to the students, producing the work, and documenting it.

McDermott will work with LESA, at RPI, to assess the effectiveness of the workshop series with respect toward student satisfaction with the outcome of their project and students' interest in thinking critically about consumer technology. This will be done through a pre and post-workshop survey. These surveys have been included below. The students who consent to, will be photographed and filmed while working to show the working process. Students will also have the option to create a short film about their work, (if time allows). Any film the students create will be their property and the artist will only display it with their permission.

Effects on Subjects: It is the artist's hope that exposure to new technological tools, coupled with the experience of designing and building a unique piece of technology, will enable the participants to think about themselves as potential creators of technology, and stimulate a greater interest in tech design. Additionally, the experience of building and thinking critically about technology might help students to think more critically about their own behavior and relationships toward technology.

Measures to Minimize Risk: The artist is making an effort to design a workshop series that will be inclusive of students at a range of skill levels and backgrounds. There will also be roles in the creation of the wearable tech piece that are less technical, so some students can choose to be more involved with creating the garment and other more artistic aspects of the piece. No student wil be required to participate in any technical element that makes them uncomfortable, (such as soldering).

The artist will make an effort to listen to the students and alter the content of the workshop to suit their skill level. Workshop participation is optional and students can drop out at any time. Additionally, McDermott will work with RPI's School of Engineering Educational Outreach and Diversity Center to develop an effective lesson plan.

Likelihood of Harm: It is unlikely that this workshop series will cause harm. There may be an option to work with glue guns and soldering irons during the project. Tech Valley High School has a lab that is already equipped with these tools. McDermott will confer with the educators at the school to decide whether it is appropriate for these tools to be involved in the workshop. It is possible that certain students may have received prior training for use of these tools, in which case only those students will use them.

Soldering and using the glue gun is optional, and not necessary to complete any of part of the project. However, it may be useful to have it available as option for those students who are comfortable with the tools.

Documentation of Risks: Risks will documented in the consent and assent forms distributed to students and parents.

Benefits to Participants: The participants will receive free access to high-level technology tools and education, and will have the opportunity to work with a professional artist. The students may be more empowered in their interactions with technology if they have a stronger understanding of how it is designed and made.

Alternate Method Not Using Human Subjects: Because I am interested in the relationship between people and technology, as well as in sharing technical knowledge, it is not possible to complete this project without students.

Qualifications of Researcher: Kathleen McDermott has an MFA in Creative Media from City University of Hong Kong, and a BFA in Sculpture from Cornell University. She has ten years of experience teaching art to children, beginning from her time at Cornell, when she voluntarily taught art at a juvenile detention center. She has subsequently taught homeless youth at the Life Center in New York City, and has taught in NYC public schools through Marquis Studios, an arts non-profit. During her time with Marquis Studios, she was required to develop ten-week lesson plans that were approved by the partner schools and fit the NYS Blueprint for the Arts and the Common Core. She has also taught at the Rye Arts Center and Digital

Media Academy. Her work as a media artist is internationally recognized, she has been included in the Ars Electronica Festival in Austria, Currents New Media Festival in New Mexico, the Wende Museum in L.A., and has been featured in publications such as The Wall Street Journal and The Huffington Post. McDermott is currently pursuing a PhD in Electronic Arts at RPI.

Recruiting of Subjects: Lana Hower, the teacher with whom McDermott is collaborating, has suggested that interested students can join the workshop with the goal of creating a piece that will address the issues raised in their Literature Senior Project, the framework of which is "stereotypes and identity". Hower has asked McDermott to present her current research, ideas, and the framework of the workshop to the class, so that the students can have an understanding of the project.

Participation will be voluntary. All students must complete a project for their literature class, but they do not have to work with McDermott to do so. Additionally, it will be made clear that students are not required to participate in any data collection, nor must they consent to be photographed in order to join the workshop.

Confidentiality: The surveys will be completed online so that no handwriting can serve as markers to identify students. Questions are geared toward evaluating the effectiveness of the workshop series, and should not prompt any sensitive personal information to be revealed. Photographs and film documentation will not contain names and will attempt to show the students' process of working on the technology, the students will not be interviewed or asked personal questions. If students choose to film the results of their project, this film will be their property and they will be free to share it with the open-source community or destroy it.

Attach a copy of any questionnaires you plan to use.

Attach appropriate Informed Consent form for subjects 18 and over. For subjects under 18, attach the Child Assent form and Parental Permission form.

Pre- Survey

Circle One

1. How interested are you in technology currently?

1	2	3	4
Not interested	Slightly Interested	Moderately Interested	Very Interested

2. How interested are you in wearable technology?

1	2	3	4
Not interested	Slightly Interested	Moderately Interested	Very Interested

3. How important is technology to your life?

1	2	3	4
Not important	Slightly important	Moderately important	Very important

4. How strongly do you think technology effects your behavior?

1	2	3	4
Doesn't effect	Slightly effects	Moderately effects	Strongly effects

5. Do you think technology design is important?

1	2	3	4
Not important	Slightly important	Moderately important	Very important

6. How would you rate your interest in this workshop?

1	2	3	4
Not interested	Slightly Interested	Moderately Interested	Very Interested

7. How would you rate your understanding of technology?

1	2	3	4
No understanding	Slightly understanding	Moderate understanding	Strong understanding

8. How would you rate you ability to create new technology?

1	2	3	4
No understanding	Slightly understanding	Moderate understanding	Strong understanding

Fill in the blanks

1. What aspect of the workshop are you most interested in?

_____

_____

2. Is there anything about the workshop series that makes you apprehensive or nervous?

_____

_____

3. What do you expect to learn from this series?

Post Survey

Circle One

1. How interested are you in technology currently?

1	2	3	4
Not interested	Slightly Interested	Moderately Interested	Very Interested

2. How interested are you in wearable technology?

1	2	3	4
Not interested	Slightly Interested	Moderately Interested	Very Interested

3. How important is technology to your life?

1	2	3	4
Not important	Slightly important	Moderately important	Very important

4. How strongly do you think technology effects your behavior?

1	2	3	4
Doesn't effect	Slightly effects	Moderately effects	Strongly effects

5. Do you think technology design is important?

1	2	3	4
Not important	Slightly important	Moderately important	Very important

6. How would you rate your interest in this workshop?

1	2	3	4
Not interested	Slightly Interested	Moderately Interested	Very Interested

7. How would you rate your understanding of technology?

1	2	3	4
No understanding	Slightly understanding	Moderate understanding	Strong understanding

8. How would you rate you ability to create new technology?

1	2	3	4
No understanding	Slightly understanding	Moderate understanding	Strong understanding

Fill in the blanks

1. What part or lesson of the workshop series was most interesting to you?

2. What part or lesson did not interest you?

3. Did the workshop series meet your expectations?

4. Do you think other students would benefit from a similar workshop series?

5. Do you think other students would benefit from a similar workshop series?

6. Please offer any additional feedback here:

Eight Week Lesson Plan:

Lesson 1- Laying the Conceptual Groundwork (80 min)

-As a group we will have a critical technology discussion. Discuss our current relationship to technology. Watch some short sci-fi clips. Discuss their relevance to contemporary state.

-Exquisite Corpse game- This is a surrealist game where a paper is folded in three parts. Students draw head, mid-section, or bottom half of a body. They can get creative (adding octopus legs for examples, when you unfold, results are usually strange, can spark creative ideas.

-Collage or drawing time- Students come up with quick, speculative designs for wearable technology using drawing or collage.

-Discussion of creative work: Talk about the drawings, how they could be turned into real technology piece. Brainstorm some sensors we might want if we were to make these projects.

Supplies:

-Projector and whiteboard

-Sci-Fi clips, clips of artists' works.

-Paper, pencils, colored pencils

-Magazine cuttings, glue, scissors

Lesson 2-Intro to creative Circuit Design (80 min)

-Wire up LEDS in series and parallel using breadboards, resistors and batteries.

-Sewing Circuits with conductive thread and Lilypad: for their first wearable project, students sew lights to a piece of clothing. They should first draw their circuit design on paper, the challenge with sewing circuits is to avoid a short! Show example of Leah Buckley biker turn signal jacket. http://www.instructables.com/id/turn-signal-biking-jacket/

Supplies:

-Projector and Whiteboard

-LEDS

-Breadboards

-Jumperwires

-AA battery packs and batteries

-Lilypad twinkle kit

-Item of clothing (students bring)

Lesson 3-Intro to designing with Arduino (80 min)

-Program lights to turn on based on sensor data. Students first learn to program basic blink sketch. They then learn to have lights turn on based on data from a photocell transistor (which can sense ambient light levels.)

-Program motors to turn on based on sensor data. Students receive quick overview of working with motors, and modify code created earlier to include motors.

-Troubleshooting. Students learn to troubleshoot their code and wiring. Instructor demonstrates how to access information from online forums, work with example code.

-AutoFilter re-design: Students make their own version of The AutoFilter (a previous project by the artist) http://kthartic.com/index.php?/class/urban-armor/ Draw a design that could use this system of motors responding to one of the sensors provided.

Supplies:

-Projector and Whiteboard

-LEDS

-Breadboards

-Jumperwires

-AA battery packs and batteries

-Servo Motors

-Photocell transistors

-Arduinos

-Arduino IDE installed on computers

-USB cables

-Internet access

Lesson 4-Plan and Start Critical Wearable Projects (80 min)

-Brainstorm in teams. Students discuss ideas in small groups (probably two groups of five).

-Group discussion and feasibility. With the class we talk about how we could accomplish these projects, viability, supplies needed.

-Break up workflow. Students discuss how they can break their project into smaller tasks, and divide the work among the group. Start working!

-If necessary, finish any of the Arduino lesson from previous week

Supplies:

-Projector and Whiteboard

-LEDS

-Breadboards

-Jumperwires

-AA battery packs and batteries

-Servo Motors

-Various sensors

-Arduinos

-Arduino IDE installed on computers

-USB cables

-Internet access

-Paper, drawing supplies

-Fabric, sewing supplies, velcro

-Cardboard

-Glue guns

Lesson 5- Working Session: Troubleshoot and Feedback (80 min)

-Working session: Students spend the bulk of the session working in groups, with the goal being to get a breadboard version working of the electronics, and the structure of the object started. ----- Instructor offers troubleshooting help.

-Feedback: Students show the group what they have so far and receive feedback from other group, they can think about design decisions in terms of how it looks, as well as technical decisions.

Supplies:

-Projector and Whiteboard

-LEDS

-Breadboards

-Jumperwires

-AA battery packs and batteries

-Servo Motors

-Various sensors

-Arduinos

-Arduino IDE installed on computers

-USB cables

-Internet access

-Paper, drawing supplies

-Fabric, sewing supplies, velcro

-Cardboard

-Glue guns

Leson 6-Working Session: Troubleshoot, PCB soldering, (80 min)

-Working Session: Students continue to work in teams.

-Instructor offers troubleshooting help.

-PCB Soldering: If students have a breadboard version working, we can discuss how to plan out a PCB circuit and solder it, to make the project more permanent and more compact.

Supplies:

-Projector and Whiteboard

-LEDS

-Breadboards

-Jumperwires

-AA battery packs and batteries

-Servo Motors

-Various sensors

-Arduinos

-Arduino IDE installed on computers

-USB cables

-Internet access

-Paper, drawing supplies

-Fabric, sewing supplies, velcro

-Cardboard

-Glue guns

-PCB boards

-Soldering irons

-9v battery clips

Lesson 7-Working Session: Troubleshoot, and Documentation (80 min)

-Group work and troubleshooting as necessary

-If students reach a point where they are happy with their project, we can discuss how they would like to document their projects, i.e. what tone they would like to set for their piece. (Humorous, serious, present it as a product?)

-Storyboard, students plan out their film

-Film, students take the footage

Supplies:

-Projector and Whiteboard

-Film cameras

-Editing software such as iMovie or Windows Movie Maker

Lesson 8- Documentation Editing and Wrap-up (80 min)

-Group work and troubleshooting as necessary

-Instructor demonstrates how to important footage and edit, for students who choose to complete the documentation portion.

-Wrap-up: We discuss how far we got with the projects, and how the students can continue working on their own, including to document their projects with photos and videos. Groups take turns presenting work to the class.

Supplies:

-Projector and Whiteboard

-Film cameras

-Editing software such as iMovie or Windows Movie Maker

B. Survey Results

Please see attached spreadsheets, TVHS_PreSurvey and TVHS_PostSurvey

C. IRB 1549 Approved Protocol 032516

Title of Proposal: Critical Wearable Workshop Series (2nd iteration) (revision)

Researcher: Kathleen M McDermott

Objective: The objective of the workshop series is for the artist to share her working process with a larger community and to facilitate creative making and creative conversation with students around the nature of their relationship to technology, and their perspectives on future technology development. The artist will give lessons on wearable technology design as way to stimulate this creative conversation and making experience. Therefore, a secondary objective of the workshop is to develop a system of teaching wearable technology design that is creative and engaging to students with little or no prior tech design experience, including circuit design and systems for interfacing with sensors. The artist is currently working on a series of wearable electronics that playfully address social issues, this project is called *Urban Armor*. To create the wearable tech pieces the artist uses exclusively open-source, DIY technology, and she shares the tutorials for the objects she makes online. As an artist/practitioner working toward a PhD, this research is motivated by a desire to explore themes in the artist's own work, around the idea that alternative techno-future narratives can be constructed by using technology as a creative material, with a larger community. Before others can be creative with wearable technology, they must gain some basic skills in production and design. Hence, a teaching component has been added to this creative, practical, co-exploration of the wearable future.

In the first iteration of the "Critical Wearable Workshop," completed in the Spring of 2016, Kathleen worked with a group of Seniors at Tech Valley High School in Albany to create 3 unique wearable technology pieces, based on social issues which the students were exploring simultaneously in their literature class, as part of their senior project. While the series was successful in the sense that the students were able to technically realize their goals, and were also quite creative with the medium, one of the limitations of the method is that it required multiple sessions with the same group of students, in order to build knowledge. For the next iteration of the workshop series, McDermott will work with Troy Middle School's after-school coordinator, to offer a six-week program. Recognizing, based on conversations with the coordinator, that students may not maintain consistent attendance, McDermott aims to complete a series

of smaller project with students, which students might complete in a single lesson, but which might also allow those students with consistent attendance to build their wearable design and production knowledge over the course of the six weeks.

Methods: After discussions with the coordinator of Troy Middle School's after-school program, Esma Simohamed, McDermott was invited to provide a short description for an after-school workshop series which will begin November 1st. Descriptions of the after-school offerings are distributed to students, and they can choose which programs to sign up for. The description is as follows:

> Wearable Technology: Designing the Future
>
> The future of wearable technology is still being decided. Right now it's Fit Bits and Apple Watches, but it's possible to make wearable technology that's much more creative, and much more tailored to you! Learn how to make circuits with conductive thread, sew lights into your clothes and even make them respond to sensors in this fun class that combines fashion and function. No experience necessary, Tuesdays, 3:30-5:30.

The workshop will consist of 6, two hour sessions, with the understanding that time will be lost at the beginning and ending of the session for clean-up and so that students can make their buses. McDermott has asked for no more than 12 students so that she can ensure a productive experience for all students, (students often need help with physical tasks such as threading needles), but the project will not be negatively effected by having fewer participants. The lesson content is outlined at the end of this document. It will focus on systems for making soft and simple circuits that do not rely on microcontrollers, and that encourage students to think about consumer electronics as something to potentially modify, repurpose and reuse.

McDermott will work with LESA, at RPI, to assess the effectiveness of the workshop series with respect toward student satisfaction with the outcome of their project and students' interest in thinking critically about consumer technology. This will be done through a pre and post-workshop survey. These surveys have been included below. Esma Simohamed has offered to distribute the links to take the surveys during the students' class time prior to beginning the workshop series and after its completion, so the researcher will not be present, and students need not feel pressured to participate. Simohamed has shared the fact that all students participating in the after-school program have already signed releases allowing them to fill out optional surveys and to be photographed, and this is a practice the students are familiar with. The Troy Middle School release is included in a separate document. At the request of the review board, an additional release form has been included to underscore the fact that survey participation is voluntary.

Effects on Subjects: It is the artist's hope that exposure to new technological tools, coupled with the experience of designing and building wearable technology experiments, will enable the participants to think about themselves as potential creators of technology, and stimulate a greater interest in tech design. Additionally, the experience of building and thinking critically about technology might help students to think more critically about their own behavior and relationships toward technology.

Measures to Minimize Risk: The artist has made an effort to design a workshop series that will be inclusive of students at a range of skill levels and backgrounds. There will also be roles in the creation of the wearable tech piece that are less technical, so some students can choose to be more involved with creating the garment and other more artistic aspects of the piece. No student will be required to participate in any technical

element that makes them uncomfortable, (such as soldering). The best alternative to soldering is to use a solderless breadboard, which allows the designer to layout a circuit without soldering. In fact, all students will be required to first prototype on the breadboard before moving to any other means of production, because it is the best way to test a circuit. (Note, this applies to lessons using wires, not thread, so Primarily lessons 4, 5 and 6). The drawback to the breadboard is that the connections are not permanent (it is quite easy to plug in and also remove components), so some students may wish to make their circuit more permanent through use of glue, tape, or solder. However, it is also possible and completely acceptable to leave the project in the breadboard stage.

The artist will make an effort to listen to the students and alter the content of the workshop to suit their skill level. For example, one lesson may be stretched across two weeks if students feel they need more time. The aim will be to ensure that students feel they have ample time to complete their work, and do not feel rushed, as this can lead to mistakes. Workshop participation is optional and students can drop out at any time.

Likelihood of Harm: It is unlikely that this workshop series will cause harm. There may be an option to work with glue guns and soldering irons during the project, but this is optional. McDermott will confer with the educators at the school to decide whether it is appropriate for these tools to be involved in the workshop. It is possible to complete all of the lessons without these tools, as many will involve sewing with conductive thread, and do not require soldering wires. (Thread replaces wire in these instances). Projects that do involve wires can be taped or glued instead of soldered, or plugged into a breadboard. Alternatively, McDermott can set up a system to solder students' work for them. The most likely harm would be for a student to prick themselves with a needle, as this is the tool that will be used in the most lessons. McDermott will make a point to demonstrate safe sewing practices before distributing needles, and to have thimbles, which can protect fingertips, and a first-aid kit on hand.

Documentation of Risks: Soldering is a useful and empowering skill when engaging with electronic design and production. There are many programs that have successfully used soldering irons with middle school students, specifically girls. One which I admire is "Techne," a music education and production program which teaches girls to make microphones and speakers. http://www.suzannethorpe.com/education. However, soldering is not mandatory, and not necessary to complete any of the circuits. There are many ways to create a piece of wearable technology. Using a breadboard, sewing with conductive thread, taping or gluing, and soldering are all viable methods. The artist hopes to expose students to all possible methods, so they can decide which production method is suitable for them. No students will be left to use these tools unsupervised. Any student who wishes to solder will do so under strict supervision of the researcher. In regard to sewing equipment and small hand tools such as scissors and glue, students already have access to these tools in classes such as home economics. They also have access to a Maker Space in their school that contains these tools. In that sense, risks outside the normal school experience are not anticipated by participating in this workshop.

Benefits to Participants: The participants will receive free access to high-level technology tools and education, and will have the opportunity to work with a professional artist. The students may be more empowered in their interactions with technology if they have a stronger understanding of how it is designed and made.

Alternate Method Not Using Human Subjects: Because I am interested in the relationship between people and technology, as well as in sharing technical knowledge, it is not possible to complete this project without students.

Qualifications of Researcher: Kathleen McDermott has an MFA in Creative Media from City University of Hong Kong, and a BFA in Sculpture from Cornell University. She has ten years of experience teaching art to children, beginning from her time at Cornell, when she voluntarily taught art at a juvenile detention center. She has subsequently taught homeless youth at the Life Center in New York City, and has taught in NYC public schools through Marquis Studios, an arts non-profit. During her time with Marquis Studios, she was required to develop ten-week lesson plans that were approved by the partner schools and fit the NYS Blueprint for the Arts and the Common Core. She has also taught at the Rye Arts Center and Digital Media Academy. Her work as a media artist is internationally recognized, she has been included in the Ars Electronica Festival in Austria, Currents New Media Festival in New Mexico, the Wende Museum in L.A., and has been featured in publications such as The Wall Street Journal and The Huffington Post. McDermott is currently pursuing a PhD in Electronic Arts at RPI.

Recruiting of Subjects: All students in enrolled in the afterschool program receive information about the different class offerings every six-week cycle. This workshop will be one of several choices. (Others include cooking classes and photography, offered by the Arts Cetner) Participation is voluntary. Additionally, it will be made clear that students are not required to participate in any data collection, nor must they consent to be photographed in order to join the workshop.

Confidentiality: The surveys will be completed online so that no handwriting can serve as markers to identify students. Questions are geared toward evaluating the effectiveness of the workshop series, and should not prompt any sensitive personal information to be revealed. Photographs and film documentation will not contain names and will attempt to show the students' process of working on the technology. If students choose to film the results of their project, this film will be their property and they will be free to share it with the open-source community or destroy it.

Attach a copy of any questionnaires you plan to use.

Attach appropriate Informed Consent form for subjects 18 and over. For subjects under 18, attach the Child Assent form and Parental Permission form.

Pre- Survey

Circle One

1. How interested are you in technology currently?

1	2	3	4
Not interested	Slightly Interested	Moderately Interested	Very Interested

2. How interested are you in wearable technology?

1	2	3	4
Not interested	Slightly Interested	Moderately Interested	Very Interested

3. How important is technology to your life?

1	2	3	4
Not important	Slightly important	Moderately important	Very important

4. How strongly do you think technology effects your behavior?

1	2	3	4
Doesn't effect	Slightly effects	Moderately effects	Strongly effects

5. Do you think technology design is important?

1	2	3	4
Not important	Slightly important	Moderately important	Very important

6. How would you rate your interest in this workshop?

1	2	3	4

Not interested Slightly Interested Moderately Interested Very Interested

7. How would you rate your understanding of technology?

1	2	3	4
No understanding	Slightly understanding	Moderate understanding	Strong understanding

8. How would you rate you ability to create new technology?

1	2	3	4
No understanding	Slightly understanding	Moderate understanding	Strong understanding

Fill in the blanks

1. What aspect of the workshop are you most interested in?

_____

_____

2. Is there anything about the workshop series that makes you apprehensive or nervous?

_____

_____

3. What do you expect to learn from this series?

Post Survey

Circle One

1. How interested are you in technology currently?

1	2	3	4
Not interested	Slightly Interested	Moderately Interested	Very Interested

2. How interested are you in wearable technology?

1	2	3	4
Not interested	Slightly Interested	Moderately Interested	Very Interested

3. How important is technology to your life?

1	2	3	4
Not important	Slightly important	Moderately important	Very important

4. How strongly do you think technology effects your behavior?

1	2	3	4

Doesn't effect Slightly effects Moderately effects Strongly effects

5. Do you think technology design is important?

1	2	3	4
Not important	Slightly important	Moderately important	Very important

6. How would you rate your interest in this workshop?

1	2	3	4
Not interested	Slightly Interested	Moderately Interested	Very Interested

7. How would you rate your understanding of technology?

1	2	3	4
No understanding	Slightly understanding	Moderate understanding	Strong understanding

8. How would you rate you ability to create new technology?

1	2	3	4
No understanding	Slightly understanding	Moderate understanding	Strong understanding

Fill in the blanks

1. What part or lesson of the workshop series was most interesting to you?

2. Can you describe one thing you learned?

3. What part or lesson did not interest you?

4. Did the workshop series meet your expectations?

5. Do you think other students would benefit from a similar workshop series?

6. Please offer any additional feedback here:

Six Week Lesson Plan:

Lesson 1- Conceptual Groundwork + Conductive thread Gloves

-As a group we will have a critical technology discussion. Discuss our current relationship to technology. Watch some short sci-fi clips. Discuss their relevance to contemporary state.

-Exquisite Corpse game- This is a surrealist game where a paper is folded in three parts. Students draw head, mid-section, or bottom half of a body. They can get creative (adding octopus legs for examples, when you unfold, results are usually strange, can spark creative ideas.

-Lastly, students will be introduced to sewing and working with conductive thread by sewing an area into the finger tip of a glove. This will allow them to use a touch screen even when wearing gloves!

Supplies:

-Projector and whiteboard

-Sci-Fi clips, clips of artists' works

-Paper and drawing supplies

-Conductive thread

-Sewing supplies

-Gloves

Lesson 2- Sewing Circuits

-Sewing Circuits! Students will see examples of creative way to sew lights with conductive thread, such as Leah Buchley's biker turn signal jacket. http://www.instructables.com/id/turn-signal-biking-jacket/. They will then plan their circuit on paper. (Circuits should be wired in parallel.)

-Students will receive instructions on how to thread needles. Finally, they will sew from a sewable battery holder to small leds with conductive thread.

Supplies:

-sequin leds

-holders

-conductive thread

-sewing supplies

-fabric

-pencils and paper.

Lesson 3- Soft Button Light-up bracelets

-This lesson can build on prior knowledge, or stand alone if students join late. Students will learn how to make soft buttons, or pressure pads, using conductive fabric, foam, wire, batteries and an LED.

-Students will first have to draw out the circuit, and to think about the way a button works by interrupting the flow of electricity through a circuit.

-They will then design how their button will look and be laid out on the fabric.

-Last they will use sewing, tape, or glue to assemble their soft circuit.

Supplies:

-paper

-conductive fabric and/or tinfoil

-foam

-insulating fabric

-wire, alligator clips

-LEDS

-Batteries and holder

-Velcro

Lesson 4- Making “smart” lights

-In this lesson we will make a simple circuit using a transistor, a photocell, resistor and diode, to limit the current entering an LED based light input. This will allow us to have the light turn on in darkness, and off in bright light.

-McDermott will show how this circuit is incorporated into things like nightlights.

-After first making the circuit on a breadboard, the students will have the option to incorporate their design into something more permanent, by soldering or hot gluing components, or by incorporating the whole breadboard into a larger project. (A breadboard is a system for electronic prototyping that does not require soldering)*

-Students should also draw a map of the circuit so that if a part comes loose, they can repair the circuit.

Supplies:

-Led lights

-Transistors

-Diode

-Resistor

-Battery

-Breadboards

-photocell

-pencils and paper

Lesson 5- Making “smart” robots.

-This lesson will use the same circuit in lesson 4, but to turn on tiny motors. McDermott will show how such motors are present in lots of cheap electronics, such as toothbrushes.

-The students will first be challenged to come up with an idea for a design, in which it would be useful or fun to have a motor turn on in darkness. We will draw out these designs.

-Then the students will build their projects, if they like they can reuse their circuit from the previous week, or make a new one.

Supplies:

-small dc motors

-Transistors

-Diode

-Resistor

-Battery

-Breadboards

-photocell

-pencils and paper

Lesson 6- Stretch sensor + Arduino

-In this lesson students will learn how to make sensors by using conductive material. The stretch sensor is created by knitting conductive thread, a structure which makes it more flexible. The resistance of the thread changes when it is stretched. This will effect how brightly an LED shines.

-We will start with learning how to knit! Then we will connect the ends of our knitting to battery leads and an LED with alligator clips, and observe the changes.

-If time allows, we will think of useful implementations for this system. When would it be good to have stretching make something brighter?

Supplies:

-conductive thread

-knitting needles

-LEDS

-wires

-batteries and holders

-alligator clips

-Arduino

Alternatively, lesson 6 may be skipped to allow more time for students to pursue or complete any of the projects they completed earlier in the series.

D. Survey Results

Please see attached spreadsheets, TMS_PreSurvey and TMS_PostSurvey