Empowering the Female Machine: Remapping Gender Dynamics in Technologically Augmented Dance

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Abstract

Empowering the Female Machine: Remapping Gender Dynamics in Technologically Augmented Dance Performance

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Empowering the Female Machine: Remapping Gender Dynamics in Technologically Augmented Dance Performance makes a "mess" of dance through the framework of feminist Science and Technology Studies (STS). Briefly defined, the practice and performance of technologically augmented dance combines human and machine-based actions, where a feedback loop occurs between technical apparatuses and a body in motion in real-time. My research question asks: in collaborative projects involving dance and technology, how do issues of agency, materiality, and gendered subjectivity arise, operate, and govern both research and development and the production processes? I argue for a historical account of gender, technology, and dance and question the very terms of relationality by articulating these dynamics that occur through particular modern and postmodern epistemic regimes. As a female dancer and technologist, my experience produces a unique form of situated knowledge and kinesthetic sense that serves as my foundation of analysis.

Through the lens of artistic practice, I weave together four distinct narratives to illustrate the complexities arising from distinct social contexts of technologies and bodily techniques in operation from the early twentieth-century to the present times. First, the historical work of modernist artist Loïe Fuller, in particular her 1895 *Fire Dance,* complicates notions of femininity by transforming the performance space into an entanglement of agents. Second, Yvonne Rainer's 1966 *Carriage Discreteness* from *9 Evenings* outlines the shift into early computational machinery and the Space Age where her work was a successful intervention into queering technology, dance, and gender in the performance event. Third, Troika Ranch's 2009 *loopdiver,* with dancer and choreographer Dawn Stoppiello and musician and computer programmer Mark

Coniglio, reveals the persistence of control in the digital era in the process and development of their work and highlights an emotive and female-centric experience of a cyborgian body. Finally, my own research-creation practice *Orbital Resonance* (2014) will address current issues in collaborative artistic practice that combines a multiplicity of gender identities and expressions through an interdisciplinary approach. Through these artistic works, my goal is to reveal a feminist STS method of making and doing the act of technologically augmented dance performance.

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Preface

My dissertation is a personal journey and a historical account of female artists in technologically augmented dance performance; an effort to give voice to and contribute stories of women nestled uneasily between the worlds of technology and of dance. From a historical to a contemporary view of artistic work (including my own), this is a narrative focusing on female artists and their collaborators that have made significant strides in both the realms of technology and dance. They have developed strategies within their specific socio-political context to counteract imposing and debilitating structures in play.

Dance historian, writer, and critic Sally Banes saw the need for a particular feminist analysis within dance scholarship in 1998, leading her to write *Dancing Women: Female Bodies on Stage*. Her methodology, as she states, "may be characterized as a close analysis of choreography, situated in artistic, socio-political, and economic contexts…Although I often use biographical information to illuminate my interpretations of the dances, I am less interested in the sociology of women's lives as dancers or choreographers than in the ways in which choreography and performance create cultural representations of gender identities" (1998, 2). In the exploration of four specific artistic works from the late 1800s to present, I am interested not only in the analysis that arises out of the aesthetic sensibilities from the performances within a particular socio-political, technical, and economic context, but also how gendered relations in dance have material effects beyond the performances, for instance, as a mode of livelihood. Moreover, I am curious to understand the sociology of women's lives within their particular era in both the merging fields of dance and of technology. I hope this dissertation accurately and humbly depicts these women's experiences, including my own, in their journeys of self-worth and self-expression.

The Importance of the Female Body from the Roots of My Matriarchal Family Lineage

Coming from the lineage of a matriarchal family structure, my connection to and awareness of female bodies has always been strong. My sister and I grew up in a family of extremely intelligent and strong-willed female role models: my great Aunt Margaret, my grandmother Jean, and my mother Anne. All these women, most my namesake, were truly

inspiring and instilled a sense of confidence and imagination that anything was possible for us. Although not all labeling themselves as such, they were feminists in their own way by the actions they took and by the support they gave. Additionally, they all had a deep sense of bodily awareness and/or artistic practice.

On my father's side of the family, my great Aunt Margaret (1917-2010) lived in Minneapolis, Minnesota, never married, and traveled the world (including Iraq, Iran, Australia, Africa, Russia, Europe, China, and more) pursuing her passion of learning different cultures and of photography. A graduate of the University of Minnesota School of Kinesiology, she became a physical education high school teacher. In 1942, she joined the Women's Armed Artillery Core as an aviation cadet and afterwards became a flight attendant for Braniff International Airways until the airline ceased operations in 1982. Before she passed away, her stories of far-away travels inspired our imagination while the artifacts she collected around the world filled our homes.

Based in both Dayton, Ohio and Boothbay Harbor, Maine, my maternal grandmother Jean (1926-2006) graduated from Western College of Women in Oxford, Ohio (now a part of Miami University) and was a professional watercolor artist exhibiting and selling locally from her two residencies. Her bodily awareness most prominently emanated from her painting practice. From hand to brush, she always painted outdoors on location with her fellow painting crew the Brown Baggers, a group of seven women watercolor artists formed in 1975, and with my mother.

My beloved mother Anne (1952-2014) was a brilliant woman. She graduated from the first coed class at Princeton with a Bachelor of Arts with majors in French, German, and Art History and minors in Mathematics and Religion with honors. She started and was captain of the Princeton Girls' Sailing Team. She had a daily practice of swimming, jogging and/or walking every morning until her last hospital visit. Like her mother, she also painted watercolors depicting landscapes of places she traveled and lived. Her interest in art led her to continue studies in the Masters of Art and Design program at Pratt Institute in Brooklyn, New York. After marrying my father, they moved to Detroit, Michigan for a job opportunity for him at Ford Motor Company, my mother continued to paint on-site locations in Detroit and around the metro area.

My mother also dealt with a long-term illness that became much more serious when I was around the age of ten. She was diagnosed with intestinal lymphangiectasia, where complications increased later in her to life to stage four kidney failure and liver cirrhosis. Her heart was extremely strong, but the rest of her body could not keep up. She shielded us from what was really going on inside her body. On the outside, her art practice, her daily routine of movement, and her deep love and connection to us kept her living as long as her body permitted without losing her independence. My sister and I were her force to live, as she is ours.

Although possibly purely coincidental, I make a link between the events that led my mother to the hospital and what was occurring for me at the same time. She entered the Henry Ford Hospital in Detroit, Michigan for the last time in April 2014 not able to breathe, while during the same month in the rehearsal process and final event for my research creation project *Orbital Resonance,* the most important thematic and daily physical practice was focused entirely on the ability to breathe. The sound of our breaths, unamplified and improvised began the performance, focusing our energy collectively to express it outwardly to the audience. With the aid of wireless microphones, our sounds were slowly amplified and spatialized around the whole room, immersing each other and the audience within an intimate inner-bodily moment that brings about and maintains life, while my mom was losing hers. I dedicate this work to my mother, for her love of art and movement.

Introduction

Remapping Gender in the Field of Technologically Augmented Dance

From my position as a female dance practitioner, digital artist, and scholar, I ask how — in collaborative projects involving dance and technology— issues of agency, materiality, and gendered subjectivity arise, operate, and govern both research and development, and the production processes. In the broadest sense, technologically augmented dance performance is a practice combining human and machine-based actions, where a feedback loop occurs between technical apparatuses and a body in motion in real-time. In recent work, two common ways to construct such feedback is through hardware sensors placed directly on the performer or audience's bodies that monitor physical actions (acceleration, tilt, direction, the bending of limbs or similar) or by camera-based motion tracking technology which attempts to extract features from moving bodies through computer vision techniques. The main impetus comes from the dancer's body while the outputs take various forms, such as sound, light, images or other apparatuses.

My project begins with the entanglement of human bodies and their hybridization with technical apparatuses, and thus works across the separate disciplines of dance, new media arts, theater, and performance studies. From the performing arts, kinesthesia (bodily knowledge) has often been, as dance scholar Susan Foster explains, "derided or dismissed within the academy…and the information it might provide has typically been received with skepticism at best. Pervasive mistrust of the body and the classification of its information as either sexual, unknowable, or indecipherable, have resulted in a paucity of activities that promote awareness of the body's position and motion, or the degree of tension in its muscles" (Foster 2011,7). In addition to dismissing information coming from the body, the components of technology intertwined with body-based practices like dance add further complications of disembodiment and objectification.

Misconstrued ideas remain prevalent in the field of dance about what technology will do to the art form, erasing the need for the body altogether. Additionally, due to technologically mediated performance, this practice may well further objectify the female dancer's body because the field of technology more broadly is so dominantly masculine. Critical inquiries have not

adequately addressed why unequal gendered patterns persist in technologically augmented dance nor what effects the additional material components have upon the research and development process and performance event within a specific socio-political moment. I aim to remap this terrain and refocus attention on how the materials, agents, and gendered subjects function within the process and performance of artistic works.

Empowering the Female Machine: Remapping Gender Dynamics in Technologically Augmented Dance Performance aims to make a "mess" of dance through the framework of feminist Science and Technology Studies (STS). In a nod to John Law's *After Method: Mess in Social Science Research*, I tackle the "complex, diffuse, and messy" aspects in technologically augmented dance performance (2004, 2). In order to unpack my research question, my approach weaves together multiple strands of thought from the practice and theory of dance and performance, technoscience, STS, and feminism, in addition to my own experience as a dancer. I also mirror Donna Haraway's stance on 'situated knowledges' when she argues "for the view from a body, always a complex, contradictory, structuring, and structured body, versus the view from above, from nowhere, from simplicity" (1988, 589). A feminist perspective provides a valuable critical awareness of how embodied subjects are still accountable for their actions and to their objects of study and how all agents play a role in the dynamic *dance* between human and non-human (whether this be technological, biological, and/or other) phenomena in the process and dissemination of knowledge.

I argue for the insistence of knowledge coming from dance, which produces a unique form of situated knowledge and kinesthetic sense. I look at how dance with the combination of technological devices operates either consistently or differently within four socio-technical realms, particularly in the way that gender relationships become inscribed and enacted over time. Moreover, this situated knowledge, coming from the perspective of female artists, is not just a product of human actions, but affected by the agency of machines, techniques, and spatial configurations.

Parallel work has been underway for decades by scholars in Science and Technology Studies (STS). One particular branch of STS speaks to real-time situations where dynamics occur between scientists and their materials in the laboratory space, trying to understand specific epistemological and ontological issues in science and technology such as reproductive technologies, protein modeling, quantum physics, and cybernetics. Many of these studies focus

attention on "nonhuman" entities (Bruno Latour and Michel Callon's term), questioning where agency also resides. STS invites me to look at agency beyond the role of the auteur position and human involvement as either dancer, choreographer, or technologist to understand their relation amongst actions that occur with and motivated by technical apparatuses in the process and performance event. There is a strong analogy between the two fields in questioning agency in human and machine interactions within particular situations.

Agency describes a site of action and how that affects the performativity of both human-non-human entities. I am accounting for human agency, as one cannot escape their body and actions, but also acknowledging that different subjectivities can arise. Additionally, when addressing agency within the process of creation and the performance event, I also take into account how technological apparatuses, spatial structures, and audience members emit agency that alters the collective creation of the work. To do this, I weave together an analytic perspective of key feminist STS concepts (Barad's agential realism, Haraway's situated knowledge and the cyborg, Myer's kinesthetic sense) with a feminist phenomenological perspective (Sobchack 1992; Kozel 2007; Noland 2009). By this dual methodological position, I can account for the multiple agents in a state of live performance and in the framing, producing, and analysis in retrospect of the live event.

In addressing different facets of agency, I focus on the performative materiality of human bodies in motion, technological apparatuses, and spatial structures that all assist or restrict action. The Oxford English Dictionary defines materiality in three important ways to my argument: (1) "the quality of being composed of matter" (2) "that which constitutes matter or material of something" and (3) "the quality of being relevant or significant" (2016). I emphasize the performativity of materiality to shift the focus of analysis from "what something *is"* to "what it *does"* in the domains of where action takes place (Drucker 2013, 1). Bodily materiality in dance is composed of the physical attributes of human bodies (sex, gender, kinesthetic, and corporeal aspects) in reciprocal action to others, by embodied movement and caring responses. As dancer and choreographer Dawn Stoppiello comments in an interview conducted by Jane Randall, "The dancers I have worked with have shaped the dances I have made. They are my material, and I am theirs" (2015, 3). Dancers' bodies do indeed shape the performance, as their bodies emit agency in the production of an event, but also receive feedback and effects in the act from all other performative participants.

Another crucial element includes the materiality of technology that is defined both by the physicality of hardware and by the so-called "intangible" phenomena of software, code, sounds, pixels, and lights (all of these attributes are not necessarily defined as physical, but are important as they insatiate visceral, sensorial, and physical behaviors). Pertaining to digital media, postmodern literary critic Katherine Hayles differentiates between how objects are understood as physical discrete entities versus the more productive mode of materiality. As she outlines, "physical attributes are necessary but not sufficient to account for technical innovation. What counts is rather the object's *materiality*. Materiality comes into existence, I argue, when attention fuses with physicality to identify and isolate some particular attribute (or attributes) of interest" (2012, 91). Materiality is a dynamic process in its existence as a "human-technical hybrid" (Ibid.). In addition to both the materiality of human bodies and technology, the materiality of the performance space is also important to consider, embodying particular histories, sensorial information, and architectural elements. All these entities do indeed have unique, physical attributes (whether tangible or not) that need to be acknowledged. As method and form of analysis, the importance is how to attune to the movements and responses of all participants in action to create a more fluid entanglement, instead of increasing separation between and dominance over each other.

To address the topic of subjectivity, I turn to feminist STS scholar Donna Haraway and her insistence on embodiment to address the subject position. To avoid misaligned pretenses to objectivity and disembodiment, Haraway calls for a particular "feminist objectivity" that is about "limited location and situated knowledge, not about transcendence and splitting of subject and object" (1991, 583). Situated knowledge challenges traditional forms of objectivity and complicates the binary of subject/object, accounting for agency of both subject of inquiry and object of study. "Feminist embodiment, then, is not about fixed location in a reified body, female or otherwise, but about nodes in fields, inflections in orientations, and responsibility for difference in material-semiotic fields of meaning (588). In acknowledging these definitions, I specifically incorporate feminist notions of agency (Barad 2007; Haraway 1991, 2008, Myers 2015), of sensorial and corporeal knowledge, of kinesthetic affect and empathy, of affective labor, and of "haptic creativity" (Myers and Dumit 2011) that create new figurations and relations to understand subjectivity entangled and immersed within the production of knowledge.

Two other crucial terms to my argument are embodiment and relationality in their application to the study of dance, gender, and technology. Embodiment is the realization of an idea manifested by practice. Dance is an embodied art form, immersed in a bodily (mind-and-body) experience outwardly expressed to others (Johnson 1995; Pakes 2003; Block 2015). Additionally, embodiment encapsulates how gendered social and cultural forms take shape by certain behaviors, forces, objects, qualities, and more. Relationality describes the entanglement (Barad 2003) of the body and technology in space and time. An importance lies not only with how dancers come to create and disseminate knowledge, but also with how the materiality (qualities, characteristics, behaviors) of both bodies and technical apparatuses affect this relationship. All of these terms allow me to decenter the focus away from purely anthropocentric aims in order to understand dance and technology as multiply constituted in a specific context. Additionally, these concepts offer the creation of new opportunities for expression, not limited by traditional Western dualisms.

I argue for a historical account of the relationship between gender, technology, and dance and question the very terms of relationality by articulating these dynamics through different socio-technical climates. Beginning with the second industrial revolution and the electric machine, the relationship and effect of technology on the gendered moving body in artistic practice is re-articulated within four technological epistemes: the second industrial revolution from 1880-1930s, the space age from 1940-1970s, the digital revolution from 1980-2000s, and the information age from 2000 onwards. In conjunction with these historical epistemes, I detail and analyze four artistic works (two historical and two contemporary) that illustrate the complexities of agency, materiality, and gendered subjectivity within specific technological advances and bodily techniques in operation from the early twentieth-century onwards. A brief investigation of technological advances, bodily techniques, and feminist perspectives all contextualize the highly complex situation of these artists.

First, the historical work of modernist artist Loïe Fuller, in particular her 1895 *Fire Dance,* entangled agencies of mover, spectator, and electrical machinery, using kinesthetic knowledge to create a magical spectacle of technology and movement. In moments both on and off stage, she shifts typical notions of gendered subjectivity by her division of self, by her development of natural imagery and hypnotic movements, and by her technical prowess in the male-dominated field of technology. Secondly, I discuss Yvonne Rainer's 1966 *Carriage*

Discreteness from *9 Evenings: Theater and Engineering*; a work which outlines the shift into early computational machinery and the Space Age. Rainer's work was a successful intervention into queering technology, dance, and gender in the performance, although persistent gendered patterns still revealed themselves in the process of development where the focus lay on promoting innovative technologies. Third, Troika Ranch's 2009 *loopdiver,* with dancer and choreographer Dawn Stoppiello and musician and computer programmer Mark Coniglio reveals the persistence of control in the digital era through the process and development of their work. Although Stoppiello and Coniglio uphold the stereotypical male technologist and female dancer partnership found in most multimedia companies[i] within the advancement of digital technology, their performance *loopdiver* highlights the emotive and female-centric experience of a cyborgian body in technologically mediated environments. Finally, my own research-creation practice work *Orbital Resonance* (2014) applies STS methods directly to create a technologically augmented dance performance in collaboration with a multiplicity of gender identities and expressions through an interdisciplinary approach.

Each of these case studies reveals a particular situation for female artists experimenting and producing technologically augmented dance work. Within distinct socio-technical climates, attention is given to gendered divisions of labor and exclusion from certain spheres of practice. Furthermore, interpersonal dynamics of dance collaborations are revealed through feminist methodologies, bodily techniques, and technological developments that influence the content and strategies within their artistic works that address problematic and productive relations.

The Disturbance and Problem

In most of the existing literature in dance-technology, theater, and performance studies, scholars have mainly focused on one dynamic to the exclusion of others. There have been numerous studies of dance and technology works (Birringer 1998, 2008; Valverde 2004; Dixon 2007; Kozel 2007; Bench 2009; Salter 2010), but little to no discussion of gender as regards to technology or dance. In the realm of dance studies[ii] (Albright 1997, 2007; Banes 1987, 1993, 1998, 2003; Burt 1995; Copeland 1983; DeFrantz 2002; Foster 1986, 1996, 2002, 2011; Manning 1993), the topics of gender and race together with more practical explorations of techniques in movement and choreography through ethnography are analyzed, but how

technology additionally complicates these notions is not addressed. At the intersection of women, art, and technology, great strides have been made to contribute to female representation in media arts, particularly around the mediums of film, sound, and telecommunications (Sobchack 1992, 2004; Marks 2000, 2009; Malloy 2003, Munster 2006; Barker 2009; Dyson 2009; Rogers 2010), but consideration of the complexities that arise told from a dancer's perspective and detailed from the practice of dance is rare. Finally, there has been a range of more closely aligned texts unpacking the dynamics between gender and technology in theater practices (Benford and Giannachi 2011; Parker-Starbuck 2011), but the vast majority of these do not branch out into the field of dance.

Within the actual field of technologically augmented dance, scholarship is relatively new and a number of problems and questions have continually framed its discourses. In 2004, Jane Frere and Mostafa Yarmahmoudi interviewed a member of Germany-based dance performance group Palindrome, directed by choreographer Robert Weschler, a company that is known for utilizing motion-tracking technology in its productions. Briefly defined, motion tracking systems combine video technologies or other external devices that use infrared radiation or sonar navigation with specific software platforms to measure the spatial environment of a body's position or movement. In the work of Palindrome, the interviewers were interested in finding out if artists still regarded digital dance as "unexplored territory and [if so] is this because the cost is prohibitive and the technology too complex?" Frieder Weiss, Palindrome's engineer and collaborator from 1995-2006 answered, "Some do but I think it's a question of specialization and it's a small field and just a few people jump over this border. Maybe it's even a gender thing; most dancers I know are women and not so interested in technology" (Frere and Yarmahmoudi 2004, 10).

Although noting that the field of dance is predominantly composed of women, when I read this statement ten years ago, I was appalled at the assumption that women were not interested in technology, as this has always been my passion and skill set. Where are the women interested in technology and where are they located within this domain? What historical factors created this dominantly masculine field of technology (to the point of exclusion), even within a field so dominated by women? In the present moment, in computer science and the technology industry at large, women and minorities are still significantly underrepresented. Although there is no shortage of female students, teachers, and professional dancers, in dance, surprisingly, female

representation is not commonplace in choreographic and production roles where creative authority is thought to reside[iii].

Even without discussing issues of gender, the field of dance + technology has been highly critiqued by the same people involved in developing both the artistic and theoretical catalogue of its works. As artist and artificial intelligence researcher Marc Downie from the Openendedgroup boldly states in his 2005 dissertation, "The existing field of "dance technology" is one with many problems. This is a domain with many practitioners, few techniques and almost no theory; a field that is generating "experimental" productions with every passing week, has literally hundreds of citable pieces and no canonical works; a field that is oddly disconnected from modern dance's history, pulled between the practical realities of the body and those of computer art and has no influence on the prevailing digital art paradigms that it consumes" (2005, ii). I hope to address some of Downie's concerns, but also to bring forth another issue that he fails to mention altogether: the complexities that arise in this practice when dealing with multiple agencies and gendered subjectivities within a specific socio-material practice.

In response (and briefly mentioning gender roles) choreographer, filmmaker, and new media artist James W. Jewett critiques Downie's assertion that this field has "few techniques and almost no theory" (2008, 29). Jewett claims that because of Downie's background in music and technology, he "completely negates the entire body of work represented by the very dancers he employs to activate his sensing spaces. Indeed, he negates the physical body as a site of knowledge and wisdom and continues a stereotypical sense of technology as disembodied" (Ibid.). Downie's work receives "unprecedented support exactly *because* of the status of the dance collaborators (Merce Cunningham, Bill T. Jones, and Trisha Brown), and the theory, practice, and canonical works they represent" (30). He views Downie's works as beautiful and powerful artistic expressions, but is troubled by his ignorance of bodily knowledge and problematic notion of disembodiment as regards to technology.

Additionally, Jewett found few resources that "come from the voices of the largely female field of dance practitioners…as most come from male practitioners whose backgrounds are in music, programming, and electronics" within the "seemingly awkward marriage between Dance and Technology" (28-29). Within this statement, two distinct problems arise within the analysis of this field when incorporating digital technology into dance performances. Firstly, dance performance has always been a collaborative art form, which has not changed with the

increasing use of technical apparatuses (electronic or digital). Numerous people from different disciplines with varying skills and perspectives come together to create these artistic works. The problem arises that in specific collaborations, the prominent voices, academically to more publically, being heard are coming from the realms of music and computer programming (mostly male), not the choreographers and dancers (mostly female)[iv]. Where are the voices of these female collaborators? Secondly, most literature from the early stages of this field of work with digital technology commonly uses marriage as a metaphor to oddly describe this field. The metaphor of marriage continually frames the discourse problematically, not only distancing dance and technology as two separate entities, but also stereotypically gendering this field as well (Farley 2002; Rosenberg 2012).

A discussion of technologically augmented dance performance is challenging because it merges both histories of dance and technology in a particular manner. An analysis of dance as a theatrical form requires an understanding of how multiple forms of artistic expression (i.e., movement, sound, lights, costumes, and more) are fused into a singular event. A discussion has to include both the ephemeral nature of a performative act versus the materiality of technology and the representational nature of textual analysis versus the non-verbal, somatic (i.e., embodied) nature of physical movement. Another problematic consequence of such an amalgamation is that stereotypical gendered relations emerge and repeat patterns that are amplified by the typically gendered division of labor in technology.

In most collaborative teams, the majority of male participants come from the realms of computer science and/or music, two disciplines that uphold the concept of hegemonic masculinity (Connell 2005), while the majority of female participants come from dance. The male practitioners, in most cases, are Caucasian, heterosexual technologists supporting the normalized ideal that computing is "based on the activities and culture of boys and men…contribut[ing] to boys' sense of belonging and girls' sense of 'outsidership'" (Margolis and Fisher 2002, 75). The computer "programmer intellect is reduced to one unified set of characteristics" and this image prevails with the male as the "disciplined thinker" (Herbst 2008, 18). In these cases, binary notions of gender problematically map the terrain where a division of power sways to the side of rational knowledge affiliated with men and technology over bodily knowledge affiliated with women and dance.

This does not necessarily have to be the case. With the introduction of electronic and, later on, digital technology within dance, there was the potential to shift away from problematic, fixed dichotomies. In modernist times in the late 1800s, the combination of new ideas around feminism, electricity, and human bodies' relationship to these new inventions all potentially could have re-imagined and changed reoccurring and persistent binary modes. According to historian James Delbourgo, "electricity defied the logic of Cartesian dualism...by putting mind and body into startlingly direct communication" (2008, 8). Rational thought and sensual, bodily experience muddled together in the innovation (cognitive act) and use of (bodily act) technology. The culture of technology and dance thus still had the potential for openness for experimentation, not restricted yet by disciplinary thought, "boys club" mentality, and codification.

In the realm of digital technologies, a liberatory potential also existed prompted by Donna Haraway's concept of the cyborg, defined as a hybrid form of technology and of the human body. Her "Cyborg Manifesto" calls for a critical, feminist method that is grounded in situated knowledge, to examine technologically mediated and embodied practices that, in turn, will counteract traditional ideas around identity and relationality. Her cyborg politics demands a different ontology, one that gives room for materiality, difference, and new imaginative figurations and ways of being beyond binary categories.

From the late twentieth century, a shift transpired "from an organic, industrial society" to a "polymorphous, information system," with an accompanying transition from "comfortable old hierarchical dominations" to what Haraway labels the "informatics of domination" (1991, 161). Feminists must engage in the practice of science and technology, for "only material struggle can end the logic of domination" (68). The potentially non-hierarchal and post-gendered aspects of virtual space in the digital era proposed by Haraway's cyborg, in conjunction with moves in post-modernist dance, to focus on the process versus product, improvisation versus choreography, diversity in performers, and non-hierarchical decision-making versus the ballet/modern master, all provided hopeful possibilities beyond problematic power relations.

Despite these possibilities and some particular exceptions, the old persistent ways formulated by patriarchy and capitalism in technology and dance within the electronic age has continued in digital practices. In questioning the genealogy of technology and raising concern about the body, media scholar Anna Munster proclaims to, "radically question the birth of digital culture as one that has been shaped largely via a binary logic. This outdated cartography has

previously forced us to either celebrate or denigrate the Cartesian mind, the disembodied gaze and the transcendence of dematerialized information as salient features of digital aesthetics. What if we were to produce instead a different genealogy for digital engagements with the machine, one that gave us the room to take body, sensation, movement and conditions such as place and duration into account?" (2006, 3).

Partly due to the radical increase of technological apparatuses interfering with/in our bodies, particularly within the field of Human-Computer Interaction, researchers still do not consider or are attentive to the "a distinct lack of attention given to the central role of movement in perception and cognition, in our agency to act in the world and our experience of it" (Locke and Roberston 2013, 1). A focus on a more kinesthetic sense is crucial in understanding bodies-in motion and technological design, accounting for the multiple perspectives of both "mover, observer, and machine… to provide a balance to the extensive amount of existing research from a technology-centric perspective (e.g., computer vision and motion analysis)" (2).

The concept of kinesthesia[v] has a rich history in multiple disciplines, including philosophy, psychology, phenomenology, and dance (Titchener 1909; Merleau-Ponty 1964; Mickunas 1974; Gallagher 2005; Reynolds 2007; Noland 2009; Sheets-Johnstone 2011; Kozel 2013; Reynolds and Reason 2012). Yet my concern is how, from philosophy, this is applied to validate bodily knowledge, and hence, knowledge produced by dance. Dancing foregrounds, as Susan Foster elaborates, "the production of kinesthetic experience, making it an important source for how the body and its movement are experienced in a given historical moment" (2011, 9). Kinesthesia is knowledge obtained from inside and outside the body, informed by movement and position, to decipher feelings and sensations from sensory organs, muscles, joints, ears, eyes, and skin.

In claiming kinesthesia as a fundamental concept in both the making of knowledge and understanding knowledge of the world itself, philosopher and dancer Maxine Sheets-Johnstone argues kinesthesia is a "*movement sense*, the experience of which constitutes a specific qualitative dynamic" (2011, 512). To acknowledge kinesthesia is to foreground bodily position and situated knowledge that accounts for sensing experiences by emotions, tactility, and other bodily senses within a particular space and time. She wants to focus the awareness back to kinesthetic knowledge as this "significance has been largely ignored in contemporary Western science and philosophy, because perception – most especially visual perception – language,

information-processing, computational modeling, and other such topics are at the focal point of contemporary attention, the primacy of movement has in fact gone unrecognized and unexamined" (114). In Sheets-Johnstone's stance for thinking in movement, kinetic intelligence informs not only how one produces and disseminates knowledge, but also how that one in contact with others are being affected by that knowledge, that in turn, produces ethically responsible ways to live in the world.

In understanding any 'bodies-in-motion', we need to account for the multiple perspectives from all agents (mover, observer, object of study) that can provide a balance to existing research favoring one over another; a more intuitive awareness of our own bodies outwardly felt collectivity where we value imagination, expression, and emotion. As Sheets-Johnstone eloquently states, "movement is the root of our sense of agency and how it is the generative source of our notions of space and time" (2011, xvii). Therefore, within any study of knowledge, a focus on a more kinesthetic sense provides an entryway to foster ethically sound practices, acknowledging our place as humans that are part of a larger collective of beings and phenomena (understanding that heternormative and hierarchical goals can still prevail).

Growing Up with Technology and Caring for My Body

Given my own experience within the mainly male-dominated field of digital technology, I have been a part of and witness to alarming and discriminating behaviors against female participation and representation in these domains. I have been the subject of doubt too many times to count about my abilities and techniques with technology (aka the imposter syndrome[vi]). I have noticed the ever-prevalent technophobic attitude in the field of dance. I have seen the progression of male technologists attaining capitalistic definitions of success and value compared to their female counterparts—choreographers and dancers struggling to voice their concerns. My hope here is thus to highlight the struggles, challenges, and strategies that female artists face and create within this hybridity of dance and technology so their stories do not get lost in the midst of an increasing technologically and gender biased mediated world.

It is not difficult to understand where my comfort level with and interest in technology originated. From the earliest of my memories, my family was at the forefront of purchasing

the latest technologically devices. My sister and I had a desktop computer in the early 1990s, running MS-DOS on an IBM computer and operating our various computer games through the command line. We used Prodigy, an online platform through dial-up telephone service, eventually rendered obsolete by the competitive members-only America Online (AOL) dial-up internet provider. The private school we attended implemented a program where students had to purchase their own Dell laptop in 1997. In the same year, I was one of the only students with a digital camera and received a cell phone one year later. With regards to media from my era, we had every device imaginable, from VHS players, camcorders, laserdiscs, cassette players, compact discs to Super Audio CDs, and DVDs to HD DVD and Blue-Ray Discs. My comfort level with technology was quite strong, where accessibility and encouragement were both at play from a young age.

Additionally, my own bodily practice of dancing since the young age of three and the deep bonds and admiration created between female family members, a connection to and a need to care for the female body, in particular, has always been present. Even at this moment, my shoulders increasingly slouch forward, pulled down by painful grief and stress from the last couple of years. The weight of my body shifts slightly to the right, a reminder of another past traumatic event that is carried along forever on that side.

Almost fifteen years ago, caring for my body became essential both inwardly and outwardly after a traumatic injury occurred in late November. Prior to the start of my senior year at the prestigious boarding arts high school Interlochen Arts Academy, I was accepted and attended two summer intensives that dramatically enhanced my dance education and training: Paul Taylor's Summer Modern Intensive at Mills College in California under the instruction of Susan McGuire, João Maurício Carvalho, and Ruth Andrien and Extreme Ballet, a summer intensive in ballet and contemporary dance at Kaatsbaan International Dance Center in Tivoli, New York under the instruction of the renowned American Ballet Theater instructors Martine van Hamel, Bonnie Mathis, John Meehan, and contemporary instructor Jessica Lang. Afterwards, I entered the school year with a renewed vigor for dance and confidence in my body in both ballet and modern techniques.

The curriculum for a senior dance major consisted of technique classes, repertoire, and composition class (resulting in a senior showcase of our choreographed works). In the winter, we performed the iconic ballet *Sleeping Beauty* where I landed the role of Graceful Fairy. The rehearsals for *Sleeping Beauty* were extremely vigorous and I began to develop pain throughout my hip region and legs. I am not one to complain or to skip out on dance class ever as I love the discipline and hard work that ballet demands in practice everyday. One day in late November, I asked permission to sit out or to mark the steps after I was feeling a considerable amount of pain during the prior technique class. The instructor admitted that I might need a day off, but that I was just going to have to push on through in rehearsal. I did. I leaped. I fell to the ground from mid-air. I went to the hospital.

Despite a range of prior complications, the momentary cause was the force of that leap where my muscles split apart my growth plate in the right hip region. The diagnosis was an *avulsion pelvic fracture of the iliac crest*, a relatively rare injury in young athletes. I was on crutches to heal for six weeks meaning absolutely no activity of any kind and had to continue physical therapy for three months before I could return to dancing. The situation became even more complex when another effect of this injury was due to diet. I had been diagnosed allergic to wheat when I was a child. I believe the consumption of gluten (that stops the absorption of calcium) attributed to this injury as well as the intense athletic activity on my body.

From this experience, I had a keen awareness of my bodily limits both inside and out, but did not have the tools to apply this knowledge and to properly care yet for my body and all of its' complexities. In reflecting back to this time, the immediate momentary losses were traumatic: not being able to dance in the ballet and the following performance and not being able to audition for college. I was a dancer who could not dance.

This was a major event that profoundly shifted my understanding of what dance is and how I fit into this field. I had a sense of how fleeting and fragile our bodies can be, but was not yet mature enough to handle such a traumatic event. My gluten intolerance was more severe then I ever imagined, contributing to my literal swollen body and psychologically skewed body image (not helped by the still persistent and unhealthy demands to attain an ideal dancer's

figure). Since delaying entrance into college, I applied and was accepted to attend the Ailey School's Independent Study Program in New York City, a vigorous program of up to fifteen techniques classes a week with daily ballet and modern (Horton and/or Graham-based) classes with supplementary courses[vii]. During this time, I was preparing my application into college programs and was befallen to another injury; I fractured my fifth metatarsal bone in my right foot.

Against all these disappointments and discouragements, I made the decision to attend Marymount Manhattan college as a Communication and Media Arts major (I was always technically savvy and sound design was a strong interest of mine). As a student, I auditioned again for the dance program and was accepted. I slowly began to take my gluten intolerance seriously and have not had a single bone fracture since. My development into other technical skills combined with the previous traumatic effects on my body led me to pursue other interests and issues alongside my love for dance.

I straddled quite comfortably the degrees in Communication Arts and Dance. I became the recording engineer and sound editor for numerous dance productions, in addition to dancing. Additionally, I collaborated with a student choreographer to create an electroacoustic composition of recorded found sounds and layered melodic tones with the use of the software program Ableton Live. I learned how to apply various digital media in employment contexts to more artistic projects in the areas of web page design, sound design, and film production. From my technical interest developed during my college years alongside my lifetime practice of dance, I decided to find a more niche program for my Master of Arts that would allow me to combine these fields in a more congruent fashion.

To continue to practice within the field of technologically augmented dance, I completed a Masters of Arts in Contemporary Performance Making at Brunel University in London, England. My practical dissertation work *Ricochet* was a collaborative performative sonic installation among three female artists: Jennifer McColl, Anne-Laure Misme, and myself. In this work, we explored live recording processes within a complex looping structure in the movement and sound. We voiced phrases of English, Spanish, and French text in real-time to

set in motion traces of bodily memories in an open space with no designated stage area. The work explored choreographic movements with technological apparatuses on and around the body (wireless microphones, a push button switch sensor in combination with an Eobody wireless interface, multichannel audio with Ableton Live software, and computer), testing the performer's ability to complete multiple actions at the same time and becoming reciprocally effected by multiple sense stimuli in the spatial environment. The audience, freely walking around the space, was left with a whirlwind of sensual experiences of the performer's memory of their own bodies physically and sonically. Departing from the proscenium stage, we welcomed an openness of the space for the audience to choose their own path in exploring the work.

For my practice-based dissertation project, Brunel University's digital lab facilitated and provided equipment for our practice-based Master of Arts dissertation. I had to coordinate with the male lab technicians to buy the correct equipment and for us both to learn the necessary software to run the technical requirements of the work. In turn, I taught my collaborators the software program to manipulate the audio data, as well as controlling the lighting board and M-Audio Control Surface, so that all three of us female performers controlled all of the technology, while still performing in the space. As co-convener Fiona Templeton wrote in my feedback form, "I agree that [having only female collaborators] was a strength of your performance, confounding the dominant/dominated model and instead empowering your collaborators, with all three both onstage performing and offstage at the controls, and controlling also from the inside" (2010).

The work departed from the norm of seeing mostly male programmer and musicians stationed behind the computer screen that manipulated what the dancers were creating in the performance space. I was aware of our vulnerability to be objectified, particularly as female performers, but this also gave us agency in our ability to operate all technical apparatuses and to perform by vocally and physically expressing ourselves to the audience within an unconventional setting. During the process, I was not aware of the power structures and multiple histories embedded in any of the technical devices, but if I did take that into account, this might have shifted what technology I choose to use and for what aesthetical

purpose.

From the knowledge obtained as a dancer, I have a particular perspective at looking and understanding the body inside and out. Dance knowledge and embodiment is obtained through the practice and the experience of *doing*, as well as learning and applying technical devices and software programs. Although I have experience in developing both the movement and technical aspects that are involved in a work, I find it hard to justify my position in any context (whether professionally as an artist in the performing or new media circuit or as an interdisciplinary scholar in academia). In regards to technology, I am not as respected or even recognized amongst mostly male technologists, as their demand of expertise is quite high and their openness to discuss and exchange knowledge is rare. In regards to dance, an attitude of elitism and protection to secure the often-fleeting establishments of choreographers and a fixed separation between theory and practice exists in the culture, making it precarious to change the trajectory of dance. My experience borders on the fringes of both worlds, not accepted in either while still creating work in both.

Context of Dance

In my background, I come from a lineage of western concert dance, learning the techniques of ballet and modern and more American-influenced styles of post-modern and contemporary dance, jazz, and tap. I learned the history of these particular styles in parallel to a daily practice of these techniques. This lineage is one of many in the practice of dance, where each particular style comes with its own histories of action and embodied forms, relations of power, and institutional constraints. The Oxford English dictionary first defines "dance" in 1894 as both a noun and a verb with origins in Old High German and Old French. Within both, common factors include a reference to types of movements (human, animal, or other) aka "to leap, skip, hop, or glide", to rhythm and music, aka "measured steps," and to emotion and feelings (aka "from excitement or strong emotion") or an "expression of joy, exultation, and the like" (OED, 2015). In fact, dance can be referenced as an act that non-human elements also participate in; "of animals taught to perform certain regular movements" and "of things inanimate: To bob up and down on the ground, on the surface of water, in the air, etc." In the

noun form, one strand defines dance as a "course of action; mode of procedure, play, game" (Ibid.).

Finally, dance is the material used to create choreography or used otherwise in a performance setting, ritual, social gathering, and more. Derived from the Greek terms "χορεία dancing + -γραφια writing,"[viii] the word choreography signifies a form of composition or a written notation of dance (OED., 2015). These definitions do not necessarily align dance or choreography with a particular human practice. In fact, anything animate (human and non-human) can dance because of embodied movement.

Within a pedagogical context, dance techniques, which mainly stem from European and American frameworks, range from ballet, modern to post-modern dance, contemporary, jazz or lyrical. Recently, dance programs have expanded to encompass technical training from multiple strands of dancing from West Africa, India, and China as well as other body-based practices like somatics (Alexander Technique, Skinner Release Technique, Pilates, Feldenkrais Method) and yoga. Most curricula require a daily practice of two or three dance techniques, a course or two of music and dance history, a class on anatomy, a composition and choreography option, and a performance of repertoire. Outside academia and more traditional dance studio settings, a range of other dance techniques and styles exist, including improvisation, social dancing, urban dancing (hip hop and breakdance), and more.

With its formal origins from the eighteenth century, choreography was a system to notate dance through written symbols and language, most notably by male practitioners (Pierre Beauchamp and Raoul-Auger Feuillet commissioned by Louis XIV and later on by Rudolph Laban between the world wars). For "let us not forget that choreographic power is genealogically majoritarian in the sense that 'choreography' names a very specific masculinist, fatherly, Stately, judicial, theological, and disciplinary project – a project that, moreover, removed from dance from its social terrain (the communal yard) and placed it in a private (courtly) chamber…dance fell prey to a Stately (and theological) apparatus of capture called choreography" (Lepecki 2007, 122). In these specific milieus, male choreographers rationalized choreography by translating movements into language or by abstracting the dancing body altogether by the abilities afforded to them by combining this art with scientific practices to obtain validity: a practice of elitism and exclusion.

From historical citations to more contemporary examples, the majority of male choreographers used the practice of choreography to rationalize physical movement for higher status and wealth. As Susan Foster clarifies, "The project of translating from moving bodies to words and symbols was embraced…as both imminently achievable and a hallmark of progress. They [Arbeau 1589; Feuillet 1700; Weaver 1706; Essex 1710] saw no opposition between the written and the live, nor did they lament the potential loss of some aspect of movement that might not be documentable….where [there was always] some kind of order desired to *regulate* that movement" (my italics, 2011, 17). More recently, the same translation of movement is occurring where male choreographers have linked their practices to technology, neuroscience, and other acceptable forms of disciplinary science to elevate the practice of dance with choreography. Some examples include Merce Cunningham and LifeForms, Wayne McGregor and his collaborations with neuroscientists and physiologists, and William Forsythe's Choreographic Objects and Motion Bank projects that have an aim of elevating dance to a "high" art practice. The translation of movement into notation negates particular knowledge from the physical body (including emotions, feelings, and sensations) paralleling similar actions undertaken by male programmers and musicians in their artistic and theoretical work with dance. Additionally, these projects, due to their high status, dominate the conversation in the public sphere, leading to an array of consequential effects including receiving more financial support and categorizing the demarcations of the field.

In contrast to the male dominated field of choreography, one particularly renowned New York City female dancer and choreographer, Twyla Tharp, defines choreography as designing creative acts in a performance event. She states that as a choreographer, she has an "extreme bias about the untapped power of movement in our creative lives. Movement and physical activity are my materials, but more than that, they're how we stay in touch with our body – and the body is how we stay in touch with the outside world" (2003, 205). She also has a sense of responsibility about her role as a choreographer, where her "dancers expect [her] to deliver…because [her] choreography represents their livelihood" (5). For Tharp, dancing allows her to stay present with herself and to communicate her expressions to others. As a choreographer, she also feels accountable and ethically responsible in how dancing functions as a career and livelihood for her performers.

Still today, however, choreography either implies a function to notate or to compose for a performance event, where the practice "has served to validate some forms of dancing while excluding others" (Foster 2011, 16). Dance scholar Jens Giersdorf elaborates on this concern stating, "the potential loss of specificity that such a definition of choreography entails, noting that it could became an unmarked strategy within transnational academic and artistic exchange that would work complicit with other forces in globalization to erase difference" (Foster 2011, 6). Foster hopefully proposes that if choreography is "conceptualized as a theorization of identity," this term can be utilized to question "what a body can be and…makes evident the ways in which dance articulates with social, aesthetic, and political values" (2011, 5). In the broadest sense of the word, Foster defines choreography as a "structuring of movement" (whether that be human or other) but where the alignment of choreography to language and regulation of human movement is still a part of its ontology and problematic (2).

The ubiquitous use of the term can be additionally problematic in other disciplines, like media technologies, biology, and other scientific practices. Similar to Tharp's definition, dance scholar Anthea Kraut stresses the importance of acknowledging choreographic works' connection to the dance-maker's bodies. In the dissemination of choreography, "the thread of dance's circulation, therefore, is that it can enact a kind of bodily commodification, turning producers into products, subjects into things. This threat carries a particular charge in a country haunted by the legacy of slavery…and in a field in which the female performing body has so often been objectified" (2015, xiii-xiv). The work of choreography, because of its corporeality, is always connected to the dance-maker and performers that enact it, in which the need to address situated knowledge is crucial within this art form.

From feminist inquiries, there are ample examples "show[ing] that there is no production of virtual relationality, whether commodified by capitalist investment or consumer society, that will not draw upon the life of somebody somewhere" (Puig de la Bellacasa 2009, 305). In a similar vein, in a discussion of current tactile technologies, STS scholar Dr. Maria Puig de la Bellacasa argues that touch screens and more haptic-based feedback technologies are not neutral and can create an overwhelming amount of sensations, where we can forget the limitations of what bodies can endure and lose connection with them. Multiple bodies (human-non-human) are still important to the practice and implication of choreography, technology, and other practices.

Additionally, dance is perceived as a feminized art form, predominantly with the female in the role of performer. Originating from the tradition of ballet, masculine identities have often been associated more frequently with choreographic and pedagogical authoritative roles (Banes 1998, 124). On the one hand, women's bodies have often been denied agency themselves, rendered as objects in servitude of male sensibilities in choreography and technology, imagined more as a muse or spirit (Burt 2006; Craig 2014). On the other hand, no "consciousness raising or revisionist history" is necessary, as dance scholar Roger Copeland phrases it, because the pioneers of modern to post-modern dance were predominantly female choreographers. During this time, the women's social and political movements focused on the ideology of the "New Woman" and equal voting rights. A shift in notions of public and private life encouraged women to redefine their position and participation in all matters of life. Due to these movements, modern female dancers found their "niche as artists and as women by staking out a flexible space at the fringes of a still uncodified artform" and by creating different figurations of roles provided by the "new woman" ideologies (Banes 1998, 125).

It is true that modern female choreographers profoundly impacted the dance scene at the turn of the nineteenth century, but economic success and prestige still wavered compared to their male counterparts. Modern female choreographers and their accomplishments were never considered the norm and highly criticized for being dramatically emotional; they still were situated on the margins in the field of dance and choreography.

Where does this leave the men? In the prominent body-based discipline of dance, the "patriachical denial of the body in western societies", choreographer Shaun McLeoud explains, "has meant [that] men have generally distanced themselves from ontological considerations of the body but also from bodily practices and expressions, except in a strictly defined and controlled way," where emotion is often suppressed (2007, 84). Additionally, prejudices against male dancers have been present since the eighteenth to nineteenth centuries, due to the denigration of effeminacy in society. This connects male dancers to homosexuality, which further marginalizes and distances them from their own bodily expression, identity, and meaning (Burt 1995; Gard 2006). Even though concerns about sexual discrimination lies beyond the scope of this thesis, I still want to acknowledge the issues of revealing identity in dance and how gender structures condition the practice of choreography. This is particular evident in the use of technologies that further disembody and rationalize thought.

Dance and choreography have a particular history, in which a prevalence of upholding binary categories and stereotypical gender roles exists. Dance, broadly defined as physical movements in a specific space and time, focuses attention to animate and embodied forms. From more codified techniques in Western culture to more social and ritual forms in a range of cultures, dance gives permission to address our own bodily position and how we interact with others. Choreography, oddly disembodied, regulates and rationalizes movement, favoring structure, control, and validation over knowledge received from the body itself. Additionally, technology, particularly computation, thus adds another layer of complexity to the history and place of dance, choreography, and subjectivity. The incursion of technology in dance worlds thus builds off an existing gender dynamic, one that played out in the very terms of embodiment.

STS Notions of Agency, Embodiment, Materiality, and Relationality

As a practitioner straddling the fields of technology and dance, a specific feminist perspective and my own lived experience within both these fields (academically and artistically) has led me to question what implications gender has on the socio-technical-political process and production of artistic works with new computer-based technology. Given the question of what forces are at work to produce a certain kind of embodied knowledge through the hybridization of technology and bodies, feminist notions of agency (Casper 1994; Munster 1999; Barad 2007; Haraway 1991, 2008; Myers 2015) are key to differentiate between where action takes place, what effects and exchanges occur there, and where power resides for multiple agents in an intra-active relation. All of these scholars consider the implications of human-non-human accountability in their aims to destabilize oppositional, categorical binaries and to unpack and re-imagine relationality. They provide a framework, method, and an analytical practice around issues of agency, embodiment, materiality, and relationality. In each case study, there is a clear distinction between the concepts of agency and notions of authorship[ix] throughout my analysis. While acknowledging most of my case studies involve auteur-based works, different agencies (human, machine, spatial) still affect the experience and outcomes within all the stages of creating and performing an artistic work.

I call for an understanding of embodied agency that cannot function without kinesthetic knowledge. In a similar vein to Carrie Noland's phenomenological account of agency and

embodiment, kinesethesia is critical because without it "the subject would not be able to distinguish her own body from other bodies; would have no capacity for independent movements; and thus would be incapable of assuming any agency at all" (2009, 9). Phenomenology gives attention to positionality, giving importance to the body and senses in creating knowledge by experience. Merleau-Ponty's existential phenomenology is "the correlation of the lived-body and the lived-world" in which the lived-body "actualizes intentionality" (Sobchack 1992, 39). With the additional feminist critiques of the assumption of the "lived-body" as male, heterosexual, and white, phenomenology is a useful method for analyzing what occurs in the experience of dance and technology performance, where the act of performing is only given life by an act of doing and seeing, engaging with an embodied subject and object of performing bodies and other technical apparatuses along with the audience's acts of vision. The "lived-body is not merely an object in the world, the flesh of its flesh; the body is also a subject in the world. It is both agent and agency of an engagement with the world that is lived in its *subjective* modality as *perception* and in its *objective* modality as *expression*, both modes constituting the *unity* of meaningful experience" (40).

For performance artist and scholar Susan Kozel, a phenomenological approach "manifests itself as a way of living in the world that integrates intellect with sensory experience and does not flinch from that which seems to be paradoxical or ambiguous: it can be used to construct meaning, to celebrate the mundane as well as the extraordinary, or to critique thought, attitudes, or social structures" (2007, 2). Alongside STS notions of agency, phenomenological accounts of agency are used to address the specific experiences of dancers immersed in technologically mediated environments. A focus on embodied agency gives room for situated knowledge, accountability, and responsibility of human bodies and their use of technology and how, in turn, this creates different type of relations.

In female body-work, in particular, persistent stigmas still occur that misrepresent the researcher and their produced knowledge. In STS, performative modalities offer the possibility to validate knowledge from what you "see, say, imagine, and feel," in addition to how body-work is "tacitly enabled and constrained" (Myers 2008, 151). Within my analysis of the four artistic works in this thesis, I pay close attention to how all participants use their bodies within the creation process and the performance event to understand what knowledge is revealed by the body itself. Moreover, acknowledging the re-distribution or inclusion of agency to involve

machines, spatial structures, audiences, and more, allows a more precise picture of all the aspects that matter in this practice that help to strategically displace the objectifying gaze of the female body.

A more attuned focus to what STS has provided theoretically, alongside the potentials of what dance performance *does*, could help bridge the gap between theory and practice in the process of creating new forms of knowledge and agency within technologically augmented dance. Within the realms of multimedia performance, there is a tendency for media technologies to reproduce Cartesian, rationalistic divides and thus, *erase corporeality*; an odd emergence indeed when thinking of dance. Sociologist Judy Wajcman makes moves within STS to understand the access, use, and development of technology specifically with reference to gender, trying to "deconstruct the designer/user divide, and that between production and consumption, emphasizing the connectedness of all phases of technological development" (2009, 149). A close attention to how different phenomena interact and *affectively entangle* each other in artistic practice frames my research and analysis of four dance performances. Through acknowledging a move away from a human-centric approach, how do other materials, techniques and space embody agency as well? To understand the dynamics that occur between agency, materiality, and gendered subjectivity within the domain of technologically augmented dance, feminist STS scholars Monica Casper, Karen Barad, and Natasha Myers (with additional insights from media and communications, performance, and dance scholars) help to unpack the issues of agency and tensions that arise in my analysis of both the historical and contemporary artistic works that are detailed in the latter chapters.

In the digital revolution era, how can we account for not only acknowledging agency in technological apparatus, but also detail the complications that arose in the precarious position of the human subject involved in this relationship? In analyzing the dynamic between human/computer interfaces, theorist Sandy Stone presents a need for a "machine ethnography" while feminist STS scholar Monica Casper questions this notion in her own methodological approach on fetuses, asking "how might one query a machine, particularly one that appears to be simply mirroring some kind of human action" (Casper 1994, 851). She acknowledges that even raising these questions assumes that "ethnography requires some kind of agency or subject" (854n6). While Casper still challenges the accountability and responsibility that human agents

have in the formation of knowledge in practice, choreographer Robert Wechsler believes that indeed a dialogue can occur between an actor and machine.

In a discussion on the use of motion tracking systems with live performers, Wechsler views the best interactive performers as the ones that have a "sense of play," that have the attitude that "if the machine is going to talk back to me, then I'll talk to it," allowing the machine's material agency to "seep in" and occur (Wechsler 2006, 73). Although his main concern is about the use of technology and the use of the term interaction, he cautions that "technology can dilute and obscure artistic intentions," leading to a "boys with toys mentality," instead of how technology can be used to reframe important issues and how technology affects the aesthetic of the work (69). Perhaps if more spaces of play exist in the creative process between the body and technical apparatuses, a topic Haraway expands upon, agency can become muddled and displaced within the realm of the anthropocene. In technologically augmented dance performance, problematic relations between the practitioners, the technology, and the movement creation process can occur. To reveal the dynamics of agency as they unfold in this field, a certain level of awareness and a better understanding of the particular materials in play would allow a more thorough investigation of power to prevent technological determinism and gender exclusion. Hopefully, more awareness, patience, and attention to agency would destabilize unproductive modes of power and control.

Although a move to acknowledge non-human agency is important, Casper still cautions that scientists "have often failed to integrate 'human' constructs of genders, ethnicities, classes, and other subjectivities into their frameworks" (1994, 848). She continues with a question pertinent to my research as well, "How can we construct new accounts of agency and take pleasure in the traffic across human/nonhuman boundaries, while simultaneously negotiating our own heterogeneous theoretical, methodological, and political needs" (852). Within a feminist framework in new media, Anna Munster attempts to answer this question. She defines this 'traffic' as a "sense of movement", in women's alliance with technology, taking into consideration that this relationship in itself does not produce "movements or flows," but suggests a new mapping of these territories with "compromise and ambivalence" (Munster 1999, 128).

The idea of a flow of energy and of movement is clearly rooted in feminist scholarship as a strategy against binary poles, to re-imagine the construction of women's identity and her relationship to technology beyond set categories. Furthermore, technology has most often been

"posed as either friend or foe, thereby bestowing upon it a monolithic and quasi-agentic status" and that, "neither science nor technologies remain innocent of the same grand narratives that motivate humanism, such as purposiveness and agency" (122). In an analysis of Sadie Plant's appropriation of Artificial Intelligence and A-Life research, Munster cautions on the "elevation of form" and the "neglect of materiality", which are repeating "old narratives and configurations of the self in which form shapes matter regardless of the qualities and intensities of that substance" (125). For her, a renewed focus on the body challenges the "pace, interaction, and relations we have and are capable of sustain[ing]" with machines. Munster views our everyday encounters with digital machines as creating new bodily experiences where the importance lies in how these different materialities produces affect and not on how they augment each other.

In another trajectory of feminist scholarship, Karen Barad furthered the understanding of agency within the ever-evolving process of relationality by her posthumanist performative approach and theory of agential realism. She utilizes the metaphoric possibilities of performance and dance to describe her argument about agency within causal intra-activity processes. Influenced by Judith Butler's performativity of gender[x], Barad wants scientific scholars to acknowledge themselves as actors, not for the mere sake of addressing gender, race, sexuality and other variables, but to critically understand how the politics, ethics, and agencies of all phenomena are entangled in knowledge-making practices. Her focus on the performativity of matter enables a shift from semiotic descriptions and representations of actions to the actual doings and observations of producing knowledge that take place between different enactments of both human and nonhuman entities in their ongoing "intra-activity."

In her theory of agential realism, Barad defines agency as an 'act', a performance, "through the dynamics of intra-activity," not an attribute that "someone or something has" (2007, 178). Agency is about an active process "entailed in reconfiguring material-discursive apparatuses of bodily production" (Ibid.). Discursive practices and materials are always entangled together, unable to be separated, dominated, and articulated without each other. Apparatuses are "constituted" through the act of particular practices that "are perpetually open to rearrangements, rearticulations, and other reworkings" which is the "creative and difficult" part of using instrumentation (technical apparatuses) in science experiments (170).

The concept of intra-activity marks an important shift to reconfigure ontological understandings of agency, matter, space, time, discourse, causality, and more. For when we

shake up anthropocentric notions and categorical divides, we "open up a space for response – that is, making an invitation to the other to respond by putting oneself at risk and doing the work it takes to truly enable a response, thereby removing (some of) the weight of the encrusted layers of nonhuman impossibilities (allowing air to circulate)" (Barad 2012, 27-28). When intra-actions have this possibility for response by change, the "dynamics of spacetime manifold are iteratively reworked through the inexhaustible liveliness of the manifold's material configuration, that is, the ongoing *dance of agency* immanent in its material configuration" (Barad 2007, 246).

Acknowledging a departure from the area of scientific knowledge produced in quantum physics, Barad's important insights into agency, to understand how particular *spacetimematterings* produce certain types of knowledge, and what role each entity plays in producing that enactment, critically engage my research in technologically augmented dance to explore the complicated and embedded histories of multiple disciplines and agents mutually constituted both in the moments of creativity and the final production of performance. Dance and Technology are two distinct knowledge-producing practices in which the combination of both produces a material-discursive practice with effects in a specific space and time. How does each discipline produce particular relations? How do the practices of dance techniques and movement creation, design of technical apparatuses and use of, and more shape what a body is and can do? I explore how technologically augmented dance produces differential becomings in particular historical and political-socio-technical contexts, as a specific material-discursive practice "through which the determination of boundaries properties, and meanings is differentially enacted" in the creative process and performance event (148). In order to understand the body and, more specifically, kinesthetic elements, I turn to Natasha Myer's attentiveness to body-based practices for guidance.

Myer's discussion around "haptic creativity" and kinesthetic elements of affect motivate my interest in searching for the metaphoric and kinesthetic links between dance, technology, and gender. Previously, Myers and Joseph Dumit investigated dance more literally to explore biologists' body-work practices in their knowledge-making experiments and in everyday contexts. They label this type of "affectively and kinesthetically engaged practice a kind of haptic creativity" that "sweeps up bodies and imaginations into a new type of knowledge (2011, 253). Scientists and their materials are constantly oscillating, where "they have become more

like partners in a contact improvisational dance, where we move together in a collaborative project that aims to evidence the affective entanglements of inquiry, more generally (249).

Influenced by her twenty-five years of training in ballet and contemporary dance, Myers in particular investigates protein modelers and their molecules with a more embodied and kinesthetic sense, paying close attention to how gesture, affect, imagination, and intuition guide their ways of study. In *Rendering Life Molecular: Models, Modelers, and Excitable Matter*, Myers details her ethnographic study of how protein modelers, specifically protein crystallographers, animate and understand their molecules in laboratories and classrooms through corporeal knowledge and other media. By doing this, she develops a concept of rendering "to account for both the performance of molecular models as they are made and used, and the performativity of molecular facts" (2015,18).

Myers sees the actions of protein modelers trying to communicate and to understand their molecules as an *improvisational dance*, for they are trying to "tune into their bodies in to one another's rendering as a means to enable fuller communication of the form and functions of particular molecules" (218). Given her dance background, it makes sense that her discussion of dance (aka body-based practices) is much more refined in terms of what techniques and training she elaborates on, improvisational dancing to contact improvisation[xi]. These specific milieus of dance have a certain process and political statement that aligns these practices as 'other', separate from traditional styles of dance like ballet, modern, or even choreography as a structured, often repressive, form. She labels these specific movements within her own daily bodily practice and that of her research subjects as "interventions," operating by "amplifying a range of practices that are otherwise muted, overlooked, or even disavowed. These are practices that remain tacit among scientists, or are otherwise not readily perceptible to observers of science" (8). The practice of dance also remains invisible to observers of technology and the public audience. Her moves within scholarship to decipher movements of scientists and of materials motivates my research to understand what knowledge is produced by dancing bodies and technological apparatuses in the laboratory of artistic creation. Myer's takes a more literal approach in her understandings of dance and performance, although, metaphorically these two key terms have been prominent in STS scholarship to understand agency for quite some time. For my analysis, her concept of haptic creativity and, in particular, to notions of affect, imagination, and intuition, all stemming from an embodied and kinesthetic sense, help to unpack

the complexities involved in technologically augmented dance. In the interpersonal dynamics that occur within dance collaborations in the process and performance event, these concepts and issues arise whether through intuition in the invention and placement of technology and movement, imagination in the creation of new aesthetic heights, or by affect in evoking empathy with the audience.

The Metaphor of Dance in STS

In addressing notions of agency, the term "dance" is used extensively in STS scholarship for its metaphorical potential, to grant importance to the different components of forces, energies, and entities at play. As Myers and Dumit state, "While STS scholars Karen Barad (2007), Charis Thompson (2005) and Andrew Pickering (1995) have developed important concepts like "intra-action," "ontological choreography" and the "dance of agencies", these dynamic descriptions do not necessarily speak to the actual movements of bodies and the relation between movement, feeling, and meaning" (2011, 248). In addition to the previously named STS scholars who use metaphors of dance, others like Joan Fujimura, Karin Knorr Cetina, Bruno Latour, and Sharon Traweek also appropriate aspects of performance to explain entanglements of matter in scientific inquiries. My project materializes the term 'dance' in understanding STS models of relationality, to look at dance itself as a material manifestation embedded with its own histories. Both its literal and metaphorical resonances are important for my project.

In STS, *dance* is a ubiquitous term. In one of the earliest adaptations of the term, Andrew Pickering describes his ideas around the "mangle" of practice by proposing that human agency and material agency engage in a dialectical dance. He states, "The dance of agency, seen asymmetrically from the human end, thus takes the form of a *dialectic of resistance and accommodation*, where resistance denotes the failure to achieve an intended capture of agency in practice, and accommodation an active human strategy of response to resistance, which can include revisions to goals and intentions as well as to the material form of the machine in question and to the human frame of gestures and social relations that surround it" (Pickering 1995, 22). Pickering proposes this posthumanist concept to offer an alternative approach to a "mangle-ish human practice" where "everything becomes in relation to everything else and

nothing is fixed. It is a nice picture to mediate upon- the dance of agency as the dance of Shiva…" (252).

In Pickering's use of the term "dance," there is still this push and pull between two distinct entities, a partnering dance where although there is no stability, there is no escaping out of the dialectic form either. Karen Barad argues, however, that while Pickering's work is important in its theorizing about material agency, he ignores important discursive practices in "poststructuralist invocations of performativity and feminist accounts of technoscientific practices" by not questioning such issues as "meanings, intelligibility, significance, identity formation, and power" (2007, 411n18). When using metaphors of dance to describe the relationship between the scientist and machines, Pickering does not factor critical points of control and situatedness that complicate the practice and knowledge coming forth from the experiment.

Dance also enters STS not only as metaphor but also oddly as method. For example, John Law describes an array of different methodological possibilities in his desire to question and modify current social science practices. As a "crafted form of practice", "Localities. Specificities. Enactments. Multiplicities. Fractionalities. Goods. Resonances. Gatherings. Forms of craftings. Processes of weaving. Spirals. Vortices. Indefinitenesses. Condensates. Dances. Imaginaries. Passions. Interferences" are all potential avenues to metaphorically imagine "our worlds and our responsibilities to those worlds" (Law 2004, 146).

Law views social scientific research methods as limited in two distinct ways. First, they are "materially restricted" and therefore, do not recognize "crafted forms of presence" seen in such examples as performances, film, dance, and other types of imaginative or spiritual practices (Ibid.). Second, they are limited "because they tend to create and make manifest absences that are taken to be independent, prior, singular, definite and passive and all the rest" which include, for example, spiritual experiences, bodily pain, and love that are hard to capture in words (147). These crafted possibilities do not necessarily have to be allegorical as there are other uses and roles for each of these, but the importance lies in the ability to escape a universality of reason and to imagine particular realities in a different way.

In using methods outside of the norms of social science for the ability "to think, to practice, to relate, and to know in new ways," Law refers to practices and forms of knowing such as embodiment, emotionality or apprehension, and situated inquiry (2-3). He imagines and calls

for a need "to imagine and practise world-making as… A choreography, a dance, a process of weaving, of partial connection and partial separation, which might then spill over too into the last great category excluded by the divisions of labour of modernism, that of the personal, the emotional, the realm of fears and loves and passions" (151). In finding alternative methods for social science, Law acknowledges the situated position of scientists and their skewed position of control when working with other subjects and equipment. Additionally, he factors in emotional responses and the validity of feelings that seep into practice.

Similar to Law's approach that emphasizes situated knowledge and ethics, Donna Haraway also uses dance as a concept to describe "world-making encounters," an embodied action for respectful and responsible relations amongst companion species (2008, 249). In *When Species Meet*, Haraway asks two main questions that feed her investigation into the relationships of humans and companion species: "Whom and what do I touch when I touch my dog? How is "becoming with" a practice of becoming worldly?" (3). Motivated by her relationship with her dog Cayenne Pepper, she investigates companion species as another type of figure to explain relationality beyond the Cyborg.

In her co-existence with her dog and other animal-human relationships she discusses, like that of anthropologist and psychologist Barbara Smut and baboons, their interactions with humans were "together in situated histories, situated naturecultures, in which all the actors become who they are *in the dance of relating*, not from scratch, not ex nihilo, but full or the patterns of their sometimes-joined, sometimes-separate heritages both before and lateral to this encounter. All the dancers are redone through the patterns they enact" (25). The concept of dance as metaphor enables Haraway to thus describe the significance of touch and play that occur when interacting with companion species.

Continuing with a discussion about Barbara Smuts' research study of baboons, Haraway explains the interactions of all actors becoming "who they are *in the dance of relating*" (Ibid.). Smuts exuded a non-threatening position to foster a more respectful relationship with the baboons, in which they could essentially remain in their natural state and environment. In Smuts' 2006 reprise of her baboon study, she elaborates on a particular greeting ritual as a type of embodied communication. As Haraway describes, Smuts' research "takes place in entwined, semiotic, overlapping, somatic patterning over time, not as discrete, denotative signals emitted by individuals. An embodied communication is more like a dance than a word. The flow of

entangled meaningful bodies in time—whether jerky and nervous or flaming and flowing, whether both partners move in harmony or painfully out of synch or something else altogether—is communication about relationship, the relationship itself, and the means of reshaping relationship and so its enacters... closely interacting bodies tend to tell the truth" (26). For "once one has been in touch, obligations and possibilities for response change," which in turn, affect the relationship and the outcome of the research (97). All dance involves touch (at some level) and close encounters, where vulnerability exists between all parties, allowing an openness for the ability and necessity (sometimes literally) to trust another body. Dance is an intuitive collaborative practice whether between performers, materials, or through engagement with the audience, all participants are embodied in a non-verbal dialogue.

Haraway further discusses the importance of play in the act of becoming more worldly through Gregory Bateson's study of mammals (monkeys and dolphins) in their "practices of metacommunication" (239). Play is about "copresence", a game that is "nonmimetic and full of difference", and an opportunity for "an opening. Play proposes…[and] lures its apprentice stoics of both species back into the open of a vivid sensory present. That's why we do it" (240-242). In the creative process of dance, notions of touch and play are crucial to explore and reshape creativity and relationality within the different phases of production and imagination. In the complex relation between technical apparatuses, technical operators, dancing bodies, spatial configurations, and spectators that occur in my research practice, if notions of touch and play are not present, an imbalance of power exists that corrupts productivity and ruins relationships.

But *why* is dance so interesting and ubiquitous in STS? First, dance operates as a liberating concept to destabilize hierarchies and to create more openness in entangled systems between human and non-human phenomena. Dance practices that include experimental partnerships and collaborations between performers, objects, technical equipment, and other through forms of contact dance, improvisation, post-modern to contemporary dance, and other non-Western styles can create more egalitarian, non-hierarchal stances and/or dynamically, shifting positions to destabilize unproductive modes of power and control. This is not to say that traditional hierarchical conditions do not exist, predominantly seen through the operation and the performances of ballet and modern companies.

Additionally, dance is not always positioned favorably in relations of power compared to other artistic domains and academic disciplines. Although Natasha Myers discusses academic

teaching laboratories that include students, postdocs, research associates, technicians, and principal investigators in her study of Protein crystallographers that work on the scale of nanoparticles, a parallel could be drawn about dance practitioners, students, technicians and more, where their "lives and labors inside and outside the lab are not immune to systematic violences, injustices, and exclusions that are contoured by capitalism, colonialism, and by intersections of race, class, and gender" (Myers 2015, 48).

Dance[xii] has always had a difficult time gaining and securing its place within "the political, social, and aesthetic discourses within our knowledge-based society" in which "the vast amount of knowledge accumulated by those in the dance community has played a rather marginal role in public debates…in the realms of politics, science, and the media" (Klein 2007, 27). Within western societies, the display of dance and the underlying processes of dance are foreign entities to the public, rendering dance knowledge neither significant nor economically viable. I hope to unpack the hidden meanings of dance to show the significance and importance of knowledge produced by bodily practice and creative production.

More hopeful, dance allows a conversation beyond purely linguistic and symbolic language that engages with a myriad of factors. The meanings derived from movement are flexible and fluid (a dance can focus on abstract and conceptual concepts, narrative-based forms, or processes of qualities and actions) from the performers, materials, and audience participation and reception in a specific spatial configuration and time frame. In dance, stillness never exists and movement can never be repeated exactly, creating an experience that has the potential for constantly evolving and transforming. These fluid collaborations and partnerships are in a constant negotiation through verbal and non-verbal dialogue that disrupts one dominant mode of thinking and doing. Additionally, although still predominantly visual, dance has the potential to go beyond vision in incorporating a more affective, sensorial, and kinesthetic enactment.

Finally, dance allows an imaginative space of the theater to explore possibilities of difficult and controversial issues without causing physical, legal, emotional, and other type of harm to others by aesthetic strategies outside the reality of life. The importance given to performative frameworks and dance in STS' concepts of agency relates to the fact that dance itself is an embodied, multi-sensorial practice which complicates the field of vision, and, in the case of technology-based dance work, also brings issues of human-non-human acts into play.

The Investigation of Four Female Artists in Technologically Augmented Dance Performance

In what follows, I explore four narratives of female practitioners and their collaborators, including my own work, that address the manner in which situated knowledge arises in human-machine-based interaction within specific socio-political contexts. More specifically, these works focus on the female dancing body and how it becomes shaped and hybridized through technical apparatuses and/or within the active performance space. In placing my own artistic work into a historical overview, I wanted to ground my experiences amongst a remapped female genealogy of the field of technologically augmented dance.

My relation to the first two chapters (Fuller and Rainer) is through a historical-analytical position. It was important to allow their voices to be heard and to detail an accurate depiction of their experiences in context. Therefore, the main research sources came from autobiographies, journal entries, biographies, historical newspaper reviews, interviews, and other primary sources. In the analysis of Troika Ranch, I use the method of ethnography over a period of ten years. My relationship with Troika Ranch began in 2006 when I saw their work *16 [R]evolutions* performed in Chelsea at the Eyebeam Art and Technology Center in New York City (now located in an interim space in Brooklyn, NY). Ten years later, this first encounter deeply intrigued me and hence initiated an investigation into this field that I am still trying to grapple with. After the initial showing, I attended the preview performance of their next work *loopdiver* in 2007 at the 3LD Art and Technology Center in New York City. During my undergraduate studies, my level of inquiry led me to interview Dawn Stoppiello about her work that took place in her Brooklyn apartment. I decided to apply and participate in their Live-I Workshop the following summer in 2008 at the 3LD Art and Technology Center in New York City. To this day, I have been in contact with them through personal communication, conferences, and more. For my own work, I take a phenomenological approach alongside my collaborators (Chandolias, Goldernberg, and Van Nort) to analyze and interpret the research-creation project *Orbital Resonance*. In upholding the concept of situated knowledge, I not only wanted to make myself accountable as immersed in this field as a practitioner and theorist, but also to acknowledge possible generational shifts as a millennial to the use and development of technology, dance, and gender.

I acknowledge the act of historicizing the self within a narrative spanning over a hundred years. My voice amongst my homage to three other female artists all needed to be heard and credited appropriately for our work in this domain. In a similar aim to historian Estelle Freedman, I also call for a feminist history. I wanted to uphold the goal of correcting, as Freedman states, "the record by excavating women's historical experiences as complex agents of social change not only to empower women, but ultimately to transform all of American culture (2006, 2). British-Australian scholar Sara Ahmed takes it one step further by calling out practices in academia as sexist. In particular, she describes citational practices as processes that "repeatedly privilege work by men (particularly when it comes to defining a new field or object of study, feminist work that leads to field formation often disappears once a field is given form)" (2014). The practice of citation most clearly demonstrates where we can "witness" the continuation of male privilege through defining academic thought, validity, and intellectual property through relationships "between men," a reference to Eve Kosofsky Sedgwick's 1985 book on homosociality, which ultimately replicates a male genealogy. She continues in mentioning sexism occurring as well when women are referenced only through their relationships to men (as the partner, as the daughter, as the pupil, and more). In placing my work amongst a female genealogy, my aim was political to redefine women's relationships by their own terms. Additionally, I aspired to create a work that continually cited and referenced the work of female artists and scholars through the fields of dance and performance studies, film and communication arts, and Science and Technology Studies. In turning to my bibliography, the majority of citations come from feminist and queer scholars.

Theoretically, the case studies address issues of material agency and body-work practices within the framework of subjectivity, embodiment, and affect, taking into consideration feminist movements and philosophies from the early 1900s to present time. I question how agency, materiality, and gendered subjectivity function within the research and development phase as well as the final performance event. In each case study[xiii], the creative process differs from what is produced in the performance event, where matters of gender and power are displayed and destabilized in varying manners. Finally, I also consider how the performance space and audience reception also contribute to and function in the final presentation of their work.

In Chapter 1: "*The Electricity Fairy:* Technologies and Techniques of Loïe Fuller and Fellow Futurist Contemporaries in Modernist Times," I examine how the American-born dancer

and inventor Loïe Fuller complicates agency, materiality, and gendered subjectivity through bodily techniques and technologies in the modernist era of electricity. In addition to Fuller's work, fellow dancers in the Futurist movement and their performances, the French-born Valentine de Saint-Point's *Festival de la Métachorie: Poemes-Drames-Ideistes de Valentine de Saint-Point* (1913/1917), and Italian-born Giannina Censi's *Aerodanze (Aerial Dances)* (1931), additionally create particular strategies and methods of working with the body and technology. I draw on a range of interdisciplinary sources to assess implicit strategies within Fuller's work and her counterparts, focused on the body, technology, collaboration, and labor roles. I use concepts such as Marcel Mauss's "bodily techniques," feminist film and STS scholars' notions of "the gaze," Hillel Schwartz's notion of "torque," and scientific aesthetics of hysteria to analyze Fuller's performance work. Additionally, I draw upon both primary sources (Fuller's notebooks, letters, and autobiography, New York Times reviews and critiques, and others) and secondary sources from cultural and performance theorists (McCarren 1995; Albright 2007; Garelick 1998, 2007).

Fuller, and her counterparts of de Saint-Point and Censi all reconfigured the dominant modernist ideal of a dancer through their embodied technologically augmented dance. All three female artists act as both performer ("represented as the object of control") and author ("the subject exerting it") complicating the idea of representation (McCartney 2000, 317). The contradictory stance, oscillation, and tension between woman as object and/or subject situate "women…both inside and outside gender, at once within and without representation" (de Lauretis 1987, 10). As directors, choreographers, and performers in their own works, all three early 20th century artists thus complicate binary notions of gender and power. Additionally, through their work with technology, they created specific milieus of movement by inventing, embodying, and replicating actions of specific technological apparatuses.

In Chapter 2: "Analog Era: From weaving rope to dancing objects: Yvonne Rainer's *Carriage Discreteness* from *9 Evenings,*" I develop a detail analysis of the process and performance of Yvonne Rainer in *9 Evenings,* in particular, to understand how issues of agency, materiality, and gendered subjectivity arise, operate, and govern both research and development and the production processes brought forth in Rainer's work. In comparison and to further understand the issue of gender within the male-based engineering world of *9 Evenings*, I also make reference to the two other female artists from the project, Deborah Hay's *Solo* and Lucinda

Childs' *Vehicle*, which I argue, additionally complicate the intersections arising between technology, art, and the body during the development of early computational machinery in the mid-late 1960s.

In contextualizing all the complex dynamics of this decade with relevance to this work and the larger performance event of *9 Evenings*, I examine the female machine tropes from the 1940s-1960s through popular fiction narratives of female programmers within a "cultural climate enthralled with first-generation computers, early electronic robots, and the Space Race that was underway" (Wosk 2015, 96). Alongside the technical innovations, specific movement systems were created after the Second World War to counter and rebel against previous established systems such as bodily-awareness practices, late modern dance, and post-modern dance. Additionally, I also reference the feminist political agendas within the counterculture movements in order to understand women's complex, often contradictory, position at this time. As Rainer reflects herself, "It cannot be said often enough that, for a young woman in 1953, everything in the culture militated toward pleasing men" (2006, 3). From the first wave to the second-wave, feminism began shifting focus from domesticity issues to more staunch radical changes around divisions of labor, sexuality, reproductive rights, and legal inequality issues.

The first section of the chapter contextualizes *Carriage Discreteness* and situates Yvonne Rainer in a particular place as a woman artist. The second section dialogues Rainer's work within the context of this era and by further reflections in recent scholarship. In the analysis of her work, the thematic concepts speak to the processes of effort, the materiality of objects and space, and the dynamics of power backed by a range of interdisciplinary sources from computer science, media and communications, performance, and cyberfeminism. Additionally, primary sources of Rainer's autobiography, interviews, and documentation of *9 Evenings*, and more inform my research. Finally, I compare the work of Hay and Childs to identify similar or contrasting perspectives of postmodernist female artists involved in the *9 Evenings* event.

In Chapter 3: "*Loopdiving Control*: Into the Digital Frontier with Troika Ranch," I focus both on the dance, theater, and new media company Troika Ranch's development of technology and their dance and media-based performances that provide an entryway into discussing the complexity of forces at work within the era of the digital divide. A mix of ideas stemming from Fuller's work in the electrical era to Rainer's work within the engineering climate of *9 Evenings*, reaches its full fruition in the personification of the digital divide and the increasing elements of

control.

I contextualize Troika Ranch's work in the influx of feminist theories from this period, including especially Haraway's figuration of the Cyborg. Technological advances opened up liberating ideas around subjectivity and identity due to the endless possibilities of virtual reality. At this time, the perceived idea from cyberfeminists argued that "female-gendered cyborgs do more to challenge the opposition between human and machine because femininity is conventionally coded as less compatible with technology than is masculinity" (Janes, ed. by Hovenden, Janes, and Kirkup, 2000, 98). In the physical world, this was not always the case. Within both the technical and movement-based worlds, issues of surveillance, power and control, and loss of individual rights created an atmosphere of fear and anxiety similar to what occurred in the early 1900s. In the field of technology, the gender gap increased, creating an unequal balance of participation, influence, and proficiency in computer science and the tech industry at large. In dance, a shift to more stereotypical roles in partnership dance maintained heteronormativity and an increase in aerobic exercise and virtuosic movements standardized notions of the body image.

Within this context, Troika Ranch's *loopdiver* and earlier work fluctuate between challenging or upholding problematic notions of agency, materiality, and gendered subjectivity within the research and development phase. In the performance event, *loopdiver* tells a different story of a gendered body in technologically augmented dance. In my analysis, I touch upon sociological notions of the technical (Wajcman 2004; Haraway 1991) to more nuanced discussions within media arts and performance (Birringer 2008; Kozel 2007; Munster 2006). Additionally, conceptual frames of affective labor and kinesthetic affect and empathy (Myers 2015) help to unpack what was occurring within the development of Coniglio's software program *Isadora* and the aesthetic sensibilities arising out of their performance *loopdiver*. Like previous chapters, my analysis draws on a range of materials including first hand experience of the live performance event, interviews I conducted with Troika Ranch, archival material and online interviews.

In Chapter 4: "*Orbital Resonance:* Feminist STS Methods as Creative Practice in the Millennial Era," I come full circle, focusing directly on my own research-creation project *Orbital Resonance* to understand the entanglements of agency, materiality, and gendered subjectivity through a collaboration that consists of multiple gender identities and expressions and of varying

modes of disciplinary to interdisciplinary theories and practices. In this work, I consider my own practice of dance and media arts, my own dancing body, and my own feminist inclinations that have effects (and produce affect) on and in the creation process and the performance event. Additionally, I consider the contributions of my collaborators and of the technical apparatuses, all in play within an immersive, sensorial performative experience. I wanted to experiment with using feminist STS methods as a way of creating and performing dance.

Similar to the partnerships between Rainer and engineer Per Biorn in *9 Evenings* and Troika Ranch, the project team included collaborations between male technologists and female performer/creators including interactive media developer and creative engineer Nikolaos Chandolias, experimental musician and sound artist/researcher Doug Van Nort and transdisciplinary researcher, dancer and multimedia artist Anne Goldenberg. Our aim was twofold: to experiment with different internal, physiological states of our bodies and to output these responses through different materials (lights, sound, movement) as well as to explore gender discrepancies in both the creation process and the performance event itself. A constant impetus and negotiation to understand the implications of all technical apparatuses and agencies from a feminist STS standpoint and way of doing was a key factor in the development of this work. In this chapter, the concepts of intra-activity (Barad 2007; Puig de la Bellacasa 2009), haptic visuality (Sobchack 1992, 2004; Marks 2000, 2002), haptic creativity (Dumit and Myers 2011), and notions of touch and play (Haraway 2008) inform my research and methods to understand the complexities that occurred in *Orbital Resonance* between bodies, media, and space.

In the current transformative socio-technical climate, I mirror the cautions prescribed by Rosi Braidotti's view of the posthuman subject. Braidotti views a posthuman subject as not only contained within the human species, but also as a "materialist and vitalist, embodied and embedded, firmly located somewhere, according to the feminist 'politics of location'" (2013, 51). Although admittedly, she no longer identifies with the "dominant categories of subjectivity," she is not quite "out of the cage," as the female sex "fell on the side of 'Otherness", her "becoming posthuman speaks to [her] feminist self…[an] allegiance to that category is at best negotiable and never to be taken for granted" (81).

Moreover, Braidotti sees a shift in how the relationship between the human and the technological other has changed from "modernist inhuman to a posthuman and post-

anthropocentric set of practices" (109). In using examples of iconic films (*L'Inhumaine* (1924) *to Avatar* (2009)) to illustrate her point, the modernist interpretation creates an analogy between the female body and the accelerating powers of technology, both "gendered and eroticized," creating affects of desire and fear (Ibid.).

At the current moment, a "technological construct now mingles with the flesh in unprecedented degrees of intrusiveness" creating a blurring of the boundaries between genders to the point of androgyny and "unexpected side-effects" (Ibid.). For Braidotti and myself, "the question of difference and power disparity remains as central as ever" (97). In a similar manner, I cannot avoid the insignificance of the female body within each of these case studies nor can I ignore the gender disparity and inequity that is occurring in both fields of technology and dance. I not only want to make space for both a discussion of particular identities but also uncover the liberating possibilities that dance merged with the technological might enable beyond binary modes of thought and action.

Chapter 1: *The Electricity Fairy:* Technologies and Techniques of Loïe Fuller and Fellow Futurist Contemporaries in Modernist Times

Loïe Fuller's *Fire Dance* (1895)

The stage is pitch black. Loïe Fuller dresses in a white gown with a white transparent scarf and takes her position on stage. The performance begins: "turning and twisting in a torrent of incandescent lava; her long tunic leaps about in the flames, curled in burning spirals, undulating and whirling, it suddenly explodes and then wilts slowly into a red blaze" (Garelick 2007, 43). Fuller's *Fire Dance* premiered at the Comédie-Parisienne on March 4, 1895 as a scene in her first production of *Salome* (Figure 1). She performed the dance later as an independent work. An 1896 *New York Times* review of "Miss Fuller's New Dance" reports on her performance at Koster & Bial "bringing with her all of the intricate mechanism, scenery, and properties, and light effects which have made her new fire dances one of the greatest success." This success "depends much on the effect of the lights" and it is impossible to "describe the effect which is produced as she circles from one stream of light to another" ('Miss Fuller's New Dance' 1896). She feverishly twirled upon a glass floor, lit from beneath to illuminate her skirt with the color of fire. Her bodily movements surged yards of fabric around the stage, and combusted into flames. She visibly rendered the dramatic and fast-paced music of Richard Wagner's "Ride of the Walkürie" with fiery rage on the stage.

By the early 1900s, Loïe Fuller was one of the most famous performers of her time. From small-time vaudeville acts in the U.S., she traveled to Paris, where she achieved overnight success at the Folies-Bergère. There, her international celebrity grew out of her spectacular theater productions. Marie Louise Fuller (later nicknamed Loïe) was born on January 15, 1862 in a Chicago suburb. Her career began in 1891, when she acted in a new play entitled "Quack, M.D." in New York. During this part, she represented a hypnotized patient. To perform this task, she "glid[ed] hypnotically about the stage" in a large, silky skirt illuminated by green footlights (Kermode 1976, 32). The presentation was a success, conjuring up images of butterflies and orchids for the audience before she dropped down "ecstatically by the hypnotist's feet" (Ibid.). Fuller, whirling around on the stage under constantly changing colored lighting that she herself designed, became an ideal canvas on which the Art Nouveau movement could project its

fantasies. She became close friends with a wide range of artists and public figures, including Isadora Duncan, Toulouse-Lautrec, Rodin, Sarah Bernhardt, Madame Curie, and Queen Marie of Romania. But her fame dissipated rapidly following her death in 1928, and what remained of her reputation involved little more than the novelty of her swirling silks.

Context of Female Modernist Artists With the Surge of Electric Power

The Second Industrial Revolution (around 1870s-1920s) dramatically altered the way human bodies and machines interacted in the Western world. This is not to say technology did not exist prior to this[xiv], but rather that the pervasive influence of new technological developments—like the typewriter, gramophone, Edison's "Kinetoscope" (a motion picture device), and electricity, in particular— transformed medical, industrial, commercial, artistic, and numerous other practices in the home and in the public sphere. One of the results of these vast technological advances and the techniques that followed was a change in the relation between human and machine in which the body, as Tim Armstrong argues, was "re-energized, re-formed, subject to new modes of production, representation, and commodification" (1998, 2).

In his essay "Techniques of the Body," sociologist Marcel Mauss wrote that bodies "can be classified according to their efficiency, i.e., according to the results of training" (1973, 77). Technologies and techniques both engendered and co-produced this new mechanized body in the modernist era, accenting discrepancies between binary modes of thinking. More specifically, women dancing embodied the border between power-laden oppositions, blurring the boundaries between mind and body, man and machine, subject and object. Within a typical masculine appropriation of power, technology, and gender, the French nineteenth-century novel by Auguste Villiers de l'Isle-Adam, *L'Ève Future*, displays the first fictitious narrative of the female machine, as a male-conceived representation of a supposedly ideal woman. English scholar Rhonda Garelick named Fuller "the real 'Future Eve'", referencing Villiers's novel, as "the first actual, historical example of the genre" (1998, 99).

Yet, within Fuller's actual lived experiences, how did she resist and modify traits of the female machine in her own artistic work? Fuller reconfigured subjectivity in dancing beyond models set out by conventional, narrative-driven concert dance. She was truly an inventor of technological devices, including the development of patents for her stage designs and costumes,

but never gained popular recognition or admiration for her technical skills. She danced in the 'lower' art scenes of vaudeville, but constantly sought to renegotiate her dancing as a respectable form of 'high' art, obtaining celebrity status and claiming ownership through multiple copyright cases and patent registrations. She became "an object of spectacle," a commoditized image for fashion and beauty products (Coffman 2002, 96). In actuality, she created two personas, one on and one off stage, in which both identities denied stereotypical renderings of the female body and sexuality. She resists the constraints of feminine embodiment in dance by reconfiguring the solo performer and altering movement techniques beyond models set out by conventional, narrative-driven concert dance (primarily ballet). Her use of her body-in motion transformed the technology for a different purpose: to abstract dance and to reconfigure the subject position of the dancer. Her artistic creations became an entanglement of agencies, using movement to express all the possibilities afforded by fabric, lighting projectors, color shifts, and stage design.

Historically renowned, Fuller's *Fire Dance* (1895) unpacks larger complex, sometimes contradictory, structures of bodily movements, technological innovations, and strategies of empowerment. To understand Fuller's work, one must consider, with the advancement of electrical power, how the interweaving of gendered subjectivity, materiality, and agency flesh out complex relationships between bodies and technology. The technological landscape, bodily techniques within dance and avant-garde artistic movements, and feminist political movements from the late 1800s to the beginning of the Second World War contextualize her specific position in time and space to address problematic power asymmetries.

Technologies of Electric Machinery

In Fuller's lifetime, the power and permeation of electrical technology transformed the relationship between bodies and machine. In the mid- to late 1800s, the "pseudoscientific theories" of phrenology and of neurasthenia were seen as revolutionizing perceptions of the human body. Three major implications occurred from these studies: "[they] recast the body as a system of individual parts […], established a precedent for regarding the body as infinitely improvable", and defined the body as having a finite[xv] amount of energy (de la Pena 2003, 5). The implications caused anxiety around issues of excess, waste, fatigue, impotence, and more (4-5). The energy of a machine could exceed a human worker, if properly maintained.

Technologies and techniques were developed to counteract the machine's ability of energy by creating an "ideal" human body. Technologies are "apparati that organize knowledge and experience," while techniques imply active directives or processes, whether in movements or manifestos (Klöck 1999, 395). Commercialized electronic devices (muscle-building machines, electric invigorators, radioactive elixirs, and others) provided technological compensation to provide more energy to the body. Using these devices to fix faults or limits within the body became an obsession by which people sought to match the power and energy of electricity.

Within these limits, Tim Armstrong describes two tendencies of power over the body: regulation and clarification. The regulated body involved creating technical devices to maintain energy flows, hygiene, beauty expectations, and more. The advertisements of electrical products for women reveal such regulations of their bodies. Women were expected to uphold an image of beauty, internalizing the energy of electricity to render their bodies soft "as one that resisted age and decay and maintained its appeal to the male gaze" (Thomas de la Pena 2003, 125). The standards of beauty demanded that their bodies be resistant to any and all effects of aging. The clarification of the body involved the "rendering-conscious of states of interiority…in the name of the scientific aesthetic" (Armstrong 1998, 5). Women were patients, studied as objects of the scientific aesthetic of physiological disorders or diseases like neurasthenia, sexual dysfunctions, hysteria, and others. Most often the scientific aesthetic is "gendered; repeatedly we will see states of interiority coded as 'feminine' succumbing to 'masculine' intervention seen as 'surgical'" (Ibid.).

Armstrong's analysis derives from Michel Foucault's identification of two different poles of power evolving from the seventeenth century. The first pole "centered on the body as a machine: its disciplining, the optimization of its capabilities, the extortion of its forces, the parallel increase of its usefulness and its docility[xvi], its integration into systems of efficient and economic control" (Foucault 1990, 139). One such example is the literary character Hadaly in Villiers's novel. Hadaly is a docile body facilitating an economic exchange between Edison and Ewald. A more extreme example occurs within the diagnosis of hysteria, wherein "male medical professionals[xvii] historically disciplined and exploited female patients with the hysteria diagnosis" (LaCoss 2005, 38).

The second pole conceived of the body as "imbued with the mechanics of life and serving as the basis of the biological processes: propagation, births and mortality…where their

supervision was effected through an entire series of interventions and *regulatory controls: a biopolitics of the population*" (Foucault 1990, 139). Foucault differentiates between individual and collective bodies, describing how power relations regulated bodies and rendered them docile in a range of social institutions (prisons, schools, hospitals, and more). To enact both poles, movement techniques were developed to assist the body in this new relation with electric technology.

Techniques of Electric Machinery

To improve a worker's ability to match the effort and energy of the machine, a range of movement-based systems were devised to train the body. The body required efficiency training, so as to counteract the natural depletion of energy and to offset fatigue. The most widely accepted techniques of the body came from men who were interested in how the machine could change the body, and included musician Émile Jaques-Dalcroze's Eurhythmics, mechanical engineer Frederick W. Taylor's Efficiency Movement and Taylorism, actor F.M. Alexander's Technique, and others[xviii].

The era of electrical power illustrated humans' fear and anxiety that technology would replace their bodies and labor. These behaviors were particularly gendered. Male theorists, influenced by their own mastery in technological design, promoted rationalism and logic as approaches that would intervene in, perfect, and align bodies to the machine. Consequently, a new focus arose within the dance canon: to create movement techniques that refocused attention back to the body. A new kinesthetic of movement formed, aligned to the rhythm of the machine, and emphasizing efforts in "pull and swing" and "movement unfolded from the center of the body" (Schwartz 1992, 77).

Between World War II to the 1950s, a range of movement techniques were developed either to train and match the effort of the constantly rapid advancement of technology, or to rebel against traditional structures altogether by refuting ballet techniques and other restrictive, societal norms. In one prominent example, dance artist and theoretician Rudolph Laban (1879-1958) created a practice and theoretical method around the idea of effort. In 1947, he noted that, "the tendency of our age to replace human-power by machine-power represents only one side of the problem of the economy of human effort" (Laban and Lawrence 1974, 8).

In the two fields of art and industry, Laban created methodologies, principles, and exercises to improve and correct the "human body engine" (Ibid.). For him, human bodies would achieve proper effort via selection and instruction. The right man needs to be hired for the right position (selection), while instruction involves "the teaching of people how to use the bodily engine in the right way" (8-9). Laban briefly explained differences in gender by describing how factory jobs would have to change to be suitable for women. In his analysis of effort, women could handle equal operations to men if their gestures adapted to their differentiation in weight to complete the job. Women could switch from lifting to swinging a heavy object in their movements to fulfill the same operations as men. From Laban's study of worker's movements came additional procedures in training for skill and efficiency.

Enriched by his military background and studies in architecture, Laban's extensive writing practice around movement grew into the creation of a symbolic system called Kinetography, more commonly known as Labanotation. On the one hand, in "challenging the vision of psychology that used to perceive the body as an instrument controlled by the mind, Laban's discourse can also be seen as the precursor of the theories of 'resurrection of the body' that became active in the second half of the twentieth century, affirming the centrality of the body and primacy of lived experience in the constitution of meaning" (Miranda 2015, 14). On the other hand, his "quantitative schematization of effort expressed through varying taxonomies, effort graphs, and charts" still rationalized bodily expression and movements (Salter 2010, 230).

Mainly due to his female partners and colleagues, Laban's legacy divides into two different approaches: Ann Hutchinson Guest developed Labonotation, a scoring technique, while Lisa Ullmann and Irmgard Bartenieff created Laban Movement Analysis, that added more bodily-focused attributes to separate from the more cognitive notions of his techniques. According to the chair of the Laban/Bartenieff Institute in NYC Regina Miranda states, "Carrying forward this thought, Laban's disciple Irmgard Bartenieff, the creator of the Bartenieff Fundamentals™ and the main disseminator of Laban's theories in the United States during the 1960s and 1970s…would later declare: 'The movement of the body is not a symbol of expression: it is expression itself'" (2015, 14). In Labonotation, the technique details the direction, the part of the body, the level in vertical space, and the length of time of a specific movement. The notation is arranged from the bottom of the page and read upwards. A further development added by Guest was the Motif notation, a component for clarifying "core elements

and leitmotifs; it highlights what stands out, is more important, or is more impressive" (Dance Notation Bureau 2016). The motif notation is written parallel to the according symbols of a movement phrase (Figure 3). The Laban Movement Analysis is a "theoretical and experiential system for the observation, description, prescription, performance, and interpretation of human movement" (Konie 2011, 1). Within the four categories of Body (inner connectivity vs. outer connectivity), Effort (flow, weight, time, and space), Shape (form), and Space (kinesphere and more), all types of movements can be described and analyzed to understand the nuances, efficiencies, and relationships between and within a particular phrase (Figure 4).

Both of these systems have been widely used for educational purposes to teach dance, for recording and copyrighting dances, and for understanding and analyzing movement detail in any bodily-oriented practice, from athletics, to dance, and videogames. Additionally, and because of the oppositional thematics present in these codified systems, as interactive arts and technology scholar Thecla Schiphorst states, "Laban's symbolic descriptions of movement form, movement properties and movement qualities provide a starting point for constructing technological movement models that can be applied equally to user experience and computational design" (2008, 201). Laban's influence stretches wide, preceding many recent choreographers attempts to score and notate their own dance works by similar means within computational systems.

Alongside techniques developed within the dance canon, avant-garde movements of Futurism and Symbolism also played a key role in articulating embodiment in this period. The Futurist agenda depended on the mechanical dissection of the body and movement to emphasize the machine. Promoting quite another agenda by glorifying war and violence, in 1909, Italian poet Filippo Tommaso Marinetti founded Futurism, described militaristically by Michael as a "general call to arms against all existing institutions, including art" (quoted in Satin 1990, 1). The Futurist movement celebrated the latest technological innovations and machines for their "liberating and energizing effects on human perception and everyday practices" (Klöck 1999, 398). Marinetti was not so much interested in creating bodily techniques to replicate the effort and energy of the machine, but rather in transforming the human body into a machine via its mechanical imitation in dance. As Ted Merwin writes, "Marinetti invented dances that, in their naïve celebration of technology, both highlighted and dismissed the very physicality of the human body by treating it as a kind of well-oiled machine" (1998, 84). In his Manifesto of Futurist Dance, Marinetti highlights his preference for Loïe Fuller's work with electrical lights

and mimicry of mechanical movements on stage. As Marinetti states, a Futurist dance "must go beyond muscular possibilities and aim in the dance for that ideal multiplied body of the motor that we have so long dreamed of. Our gestures must imitate the movements of machines assiduously paying court to steering wheels, tires, pistons, and so preparing for the fusion of man with the machine, achieving the metallism of Futurist dance" (1917, quoted in Rainey, Poggi, Whitman (Eds.) 2009, 236). Technology was both an extension of and a replacement for the human body, most exemplified by the art form of dance.

Symbolism was born in Paris, France, and included such renowned poets as Stéphane Mallarmé and Paul Verlaine, and writer Auguste Villiers de l'Isle-Adam. The movement's main focus was interior bodily states, and the belief that attunement to such states could reveal the mysteries of life. Similar to Futurist aims of promoting a "demystified and dehumanized aesthetic," invoking abstract geometric shapes and repressing personal expression, particularly from the face, Symbolism also did not want artists to express their individuality (Merwin 1998, 73). The intention was to understand more universal states and features, including the "depersonalization of the performer, interrelationships of the senses, […] mystery and atmosphere, […] geometric symbols and light and shadow, and emptying out of the performance space" (Satin 1990, 1). Artistic creativity relied on imagination, dreams, and magic to counteract rationalism and the materiality of technology and to heighten spiritual experience and expression. Futurism and Symbolism fleshed out the human-machine relation, as well as its gendered nature. In order to counteract the energy and effort of machines, these actions amplified the fragmentation of the human body, extended the body, or replaced the body altogether. As to gender, not only were women excluded as innovators in technology, they were mapped unto the machine itself.

The female machine derives from French Symbolist writer Villiers de l'Isle-Adam's novel *L'Ève Future* in 1886. The novel expresses male anxiety over technology and the first wave of feminism, responding in fictional form by regulating the gendered body of the main female character. Villiers was born into a Catholic aristocratic family, and his writing provides an image of how gender operated in and through the spectacle of technologies and male-constructed femininity. *L'Ève Future* depicts the range of sentiments about technology through the creation of a female machine— the commodification and fetishization of the female body. The story revolves around the male protagonist Thomas Edison, based on and named after the

real-life renowned American inventor Thomas Edison, who constructs a female android, Hadaly, for his heart-broken friend, the British noble Lord Ewald.

The female automaton is created in the image of Lord Ewald's love interest, the actress Miss Alicia Clearly, whose beauty is the epitome of perfection as reflected in the sculpture *Venus Victrix*[xix], but whose soul is base and banal. Because he could fall in love only once and was "unable to master his despair over Alicia's vulgarity," he threatens to take his own life (Garelick 1998, 82). Edison, however, proposes the creation of a new and improved Alicia (Hadaly) to save him, where "the present gorgeous little fool will no longer be a woman, but an angel; no longer a mistress but a lover; no longer reality, but the IDEAL" (Villiers De L'Isle-Adam and Adams 2001, 54). He creates life in the automaton by capturing recordings[xx] of the actress Alicia's voice. Throughout the novel, Hadaly reflects numerous paradoxes; "living suspended between the worlds of human beings and inanimate objects" (Garelick 1998, 83). She is not alive, yet the artifice of a soul is achieved through the sonic traces of Alicia's voice.

Additionally, Ewald's lover is sterile, not able to reproduce. Villiers denies his female android the ability to become a mother, rendering her an erotized object for male desire. Villiers's refusal to create a fertile female android is problematic as he bestows the power to reproduce[xxi] life itself to Edison. As Edison remarks, "The techniques of reproduction, of *identification* have been rendered more precise and perfect…we shall be able to realize—that is, to make real—potent phantoms, mysterious presences of a mixed nature, such as pioneers in the field could never have conceived" (Villiers De L'Isle-Adam and Adams 2001, 61). The novel ends in ambiguity. Rhonda Garelick argues, "not only does the novel hint that Edison's product is ultimately estranged from him, it leaves us with a plot that has run away from its narrator" (1998, 93). Perhaps Villier came to the realization that trying to represent women, even in fiction, was a difficult matter.

The female machine developed in parallel to the early stages of the women's suffrage and the creation of the ideology of the "New Woman," both Eurocentric movements that only included white, well-educated and career-driven women. The British periodical *Freewoman* (1911) created this new ideology of femininity, defined by "individuality, autonomy, and creative talent," where women should resist the promoted ideals of "self-sacrifice, obedience, [and] duty" (Lusty 2008, 253). Historian Mary Louise Roberts argues that during reconstructions of societies after the war, discourses on gender, in a particularly non-

intersectional analysis, proposed "three very different modes of femininity in order to take account of, and understand, social change - the reassuring mother, the disruptive new woman and the ambiguous single woman" (Kershaw and Kimyongür 2007, 6). As women were continually encouraged to embrace motherhood for the good of the nation, men's biological inability to give birth intensified their urge to master technology, and in particular, reproductive technologies.

The key themes in the novel highlight the basic idea of men controlling women and more specifically, their perfectly beautiful bodies. The novel equates woman with technology, as a commoditized and fetishized object for male desire. The author depicts the fear not only of machines replacing humans, but also men's anxiety around women's social and political movements at that time. *L'Ève Future* is one of the earliest renditions of the female body as a machine, a repeated trope that continually haunts the entangled histories of women, technology, and art, and is reinforced by social norms and popular culture or challenged by female artists in their creation of new figurations. Fuller, de Saint Point, and Censi all struggled with the ideals and expectations of stereotypical notions of femininity, but through their artistic works, were able to create new figurations of subjectivity by attending to the agency and materiality of the dancing body, technological apparatuses, spectators, and scenography.

Flames Emerge: The Kaleidoscope of Agency, Materiality, and Gendered Subjectivity in Fuller's *Fire Dance*

This context situates Fuller's dance practice within a more generalized (and gendered) concern with the human/machine relation. In an attempt to create a particularly embodied and feminized form of electrical machinery, Fuller creates a phantasmagoria of fire "burning ever higher and brighter until there was nothing left but a tiny glowing ember flickering in the air" and slowly disappearing into the dark (Sommer 1981, 395). To create the effects of the flames in *Fire Dance*, Fuller invented an "underlighting device" to project red and yellow lights below a glass pedestal and extended the size of her skirt through wooden poles sewn into the fabric. The projector, a proto-cinematic device, consisted of rotating platforms of gelatin disks of either solid colors, color combinations, or specially painted designs to create special effects (Garelick 2007, 42). Throughout Fuller's life, she shifted typical notions of gendered subjectivity by her division of self, by her development of natural imagery and hypnotic movements, and by her technical

prowess in the male-dominated field of technology. The performance of *Fire Dance* entangled agencies of mover, spectator, and electrical machinery, using kinesthetic knowledge to create a magical spectacle of technology and movement.

One of Fuller's strategies that framed her subjectivity and maintained her empowerment is the division of self between her on and offstage persona. In her autobiography in 1913, she elaborated on her two identities: "the 'little soubrette' with the 'noble soul,' [and] the 'fat lady' with the orchid and butterfly, the simultaneous self-destruction and self-creation" (McCarren 1995, 756). Off the stage, an altogether other reality is portrayed, in which, amongst a slew of "misperceptions there is one truth: she was, in fact, pudgy" (Sommer 1981, 389). In contemporary descriptions of Fuller's physical appearance and age, Garelick additionally comments about Fuller's lack of a typical dancer's body, of sexual appeal, and of youth. As Garelick remarks, "To say she was unglamorous is an understatement. Her round face, wide blue eyes, and short, stout body gave her a cherubic rather than sultry look. And at thirty, Fuller was nearly of retirement age for a music-hall dancer of that time. Offstage, she dressed haphazardly in oversized clothes, kept her hair in a tight bun, and wore little round spectacles" (2007, 3). Although acknowledging that early 1900s upheld a staunch stereotypical image of female bodies both in ballet and burlesque, the expectations of typical dancer's bodies as pin-thin and svelte[xxii] are still upheld by recent scholars. Fuller's split persona created a strategy to avoid these preposterous expectations.

Additionally, Fuller understood her characters as fostering children's imaginations. In Fuller's performance act, and reflected in her biography, children had a particular affinity for her representation of a fairy. Children wanted to meet the celebrity performer herself. In one such encounter, a child couldn't believe the real Loïe Fuller to be the dancing fairy, as Fuller recalled in her biography. At that moment, Fuller decided not to crush the imaginative hold her creation had on the child. She consoled the child and expressed to her, "Yes, my dear, you are right, I am not Loïe Fuller. The fairy has sent me to tell you how much she loves you and how sorry she is not to be able to take you to her kingdom" (1915, 138). She created a split persona, the "on" and "offstage" Fuller. This "multiple, mobile subjectivity, created by her art becomes the subject of her art…a healthy multiplication of identities rather than a disturbing fracturing of a whole" (McCarren 1995, 756). She maintained the allure of her imaginative figurations separate from her individualized persona, a strategic move in a business and culture that demanded eternal

beauty and youth. This split persona is a strategy that blurs the boundary beyond strict binary notions of subject and object, creating a new figuration to understand subjectivity entangled and immersed within the production of dance and technology.

Another strategy to maintain empowerment was Fuller's embodiment of a modernist paradox: displaying feminine qualities by projecting natural imagery onto the body during performances, while removing her female form altogether using stagecraft and costumes. Recent analysis and interpretations of Fuller's work highlight her ability to challenge gender norms through her use of costumes and technology to represent modernist images of femininity through nature. Literature scholar Julie Townsend in her 2001 article "Alchemic Visions and Technological Advances: Sexual Morphology in Loïe Fuller's Dance" argues Fuller's performance works and identity transform and escape categorical limitations on gender, lending themselves as a precursor to future female performance artists and filmmakers. Townsend interprets her "experience and representation of her body" as a strategy with "lesbian implications….[B]y constructing herself as Other (insect, serpent, butterfly), Fuller removed herself from the realm of gender altogether" (83). In researching critics and spectators active in Fuller's time, Townsend notices two distinct interpretations of her stage identity: "some portrayed her as a chaste ethereal spirit, and others saw her image as erotically invested" (Ibid.). Townsend concludes both representations make Fuller "unavailable to the male heterosexual viewer" (Idem.). Fuller does create a paradoxical position for women, but never is she able to escape from her gender.

On cabaret stages, Fuller did not uphold the expected images of female burlesque performers. She was not performing highly sexualized skirt dances for the erotic desire of a typically male heterosexual gaze. This was never her intention. Male patrons were not her intended audience and therefore, she initiated matinee performances at the Folies-Bergère to cater to woman and children. This elevated the respectability of the music hall, away from bawdy entertainment, to more respectable forms of art and to more diversity in the audience (Coleman 2002, 316). Additionally, Fuller confronted the expectations of the female body, reinforced in ballet productions, by refusing to play "coquettishly with the desirous gaze of the audience" and by challenging the characteristics of slender, weak, and subservient ballerina roles of sylphs, dolls, swans, and more (McCarren 1995, 757). Fuller did not play a specific character within a highly choreographed narrative of typical renderings of heterosexual romance, as was

the case for women in ballet. Her body enacted natural dancing apart from the highly disciplined training and performance of codified ballet technique. Additionally, she did not have to abide by or compete for hierarchically ranked roles in the ballet company. The structure in a ballet company, which persists today, ranks dancers hierarchically by their talent and duration with them. The most prestigious and exceptionally talented prima ballerinas perform the main characters of the stories in solo and pas de deux formats, while others form the corps of ballet. Fuller used improvisation through a unique solo-performer format in an abstract manner by technology and spatial designs. Fuller created a unique persona by drawing upon natural elements, what now might be considered essentialized feminine codes of representation. She embodied the contradictory position of herself as relatively invisible and as a hyper-visible star to transcend typical representations of a female performer.

In addressing the notion of the gaze and how power is embedded in visibility, I turn to theoretical frameworks that describe a particular male gaze (Mulvey 1988) and to broader considerations elaborated by feminist film and STS scholars. Mulvey's concept of the male gaze depends on the subject/object divide, associating the position of the male as the active looker over the position of the female as the passive and victimized 'looked upon.' Although Mulvey's work is of unquestionable significance, it still structures itself around a binary system, which it implements to analyze positions around dominance and power. In opposition to Mulvey, Donna Haraway not only wants to eliminate all binary notions of the gaze, but also "to insist on the embodied nature of all vision and so reclaim the sensory system that has been used to signify a leap out of the marked body and into a conquering gaze from nowhere" (1988, 581). Eliminating the significance and assumption that all subjects of the gaze are white men, Haraway wants to go beyond categorical distinctions like gender, class, and race to acknowledge the complexities of power in which no one is necessarily innocent in the subject position. To practice feminist objectivity means to go beyond binaries of subject/object in our analysis and creation of knowledge to allow "us to become answerable for what we learn to see" (583). Motivated by the insights of Haraway, feminist film theorist Jennifer Barker reinterprets the gaze away from purely visual readings to more embodied notions as well. She questions how power is "mobilized and exchanged" by "characters, the camera, and the viewer" through a "web of gazes with a feel for touch and movement, temperatures and textures" (Barker 2009, 25). In this different exchange of gazes, a focus to the film's materiality is highlighted to understand how it changes

the experience of viewing. A focus on the materiality of the body, of technology, and of the spatial setting allows seeing Fuller's work as a more visceral experience with a multitude of agents.

To emote a particular experience to the audience, Fuller uses technology to visibly render immaterial elements of sound and light, the body to enact these elements through movement and costumes, and set designs to give the performance dimension. In turn, the technological apparatuses and spatial designs transform her body into a mirage of different figurations that all point to a type of intra-active entanglement as the performance event. "For her there was no division between the performer and the scenic elements," states Sally R. Sommer, "Everything was phrased to make a seamless unity of sound and sight…tinted lights dances, just as silk, set in motion by the dancing body, swirled in its eloquent dance" (1981, 390). There was no division between the multiple participants, but a formation to make a seamless union between materials, initiated by the moving body. Fuller made the invisible and immaterial elements tactically permeate through the projection of her moving body immersed in a technologically mediated environment.

In her work as a technical innovator and as mover on stage, she had an acute sense of how the different materials worked to alter effects in her performance event. In a 1914 interview about the interconnectedness of movement and music, Fuller stated that "Specialists of the dance do not understand that I aim only to give an harmonious impression, trying to express the spirit of the music…as the waves unfurling on the shore continue to obey the breath of the wind…I try to follow the musical waves…to make it the delight of the eyes, to render it pictorial, to make it visible" (1914, quoted in Sommer 1981, 390). A feedback loop exists between the materiality of her corporeal body, in its kinesthetic capacities for action, and the technological effects and behaviors, the audience, and the space. Fuller "fashioned not a stage persona – female dancer as object – but rather embraced the notion that she could present the essence of movement without the visible presence of the human body" (Coleman 2002, 312). Fuller displayed the female body and used technology in atypical ways.

Despite these productive actions in Fuller's performance, artists and intellectuals alike continually imposed stereotypical iconoclastic feminist tropes onto her body. For example, after viewing Fuller's *Fire Dance*, the Belgian symbolist poet Georges Rodenbach wrote a 58-line poem published in *Le Figaro* depicting Fuller as a "seductress, reminiscent at once of mythic

warrior women and the ultimate temptress, Eve. At the same time, the serpents writhing about her suggest the petrifying power of a Medusa…all iconic women associated with death and the downfall of men" (Garelick 2007, 163). Rodenbach collapses three extreme versions of femininity unto the one figure of Fuller, revealing not only the impactful power of her performances, but also, more generally, his fear and anxiety of women, of technology, and of dance. In any case, his elaboration on the mythic qualities of her actions disregards Fuller's creativity. Her embodiment of flames is by her own volition and technical training, not by some mythic powers. His poem suggests that Fuller's work is both "technological and biological," depicting "deeply female, birth-like violence with which she tears open the space around her…Fuller seems to have set the air itself on fire, violently opening up a distinctly feminine, even vaginal rupture – a bleeding flower—in the planar space around her" (164-165).

Rodenbach's poem details the complicated position of women working with technology at the time. He demonized Fuller with his argument that these iconic female figures that have some inherently fictitious technological prowess (in other words, no training or ability in their own right), with an end goal to destroy men. For Fuller, replicating feminine imagery was a calculated decision. With regard to expressing and emoting particularly sexualized images, Garelick compares Fuller's performance works to a dance known as "flagging" that emerged in the 1970s at gay nightclubs in Chicago and San Francisco. Although she resists "labeling Fuller's work uniquely 'queer', the proximity of her work to flagging does remind us that those whose erotic self-expression brings with it the risk of social ostracism" (2007, 230).

Furthermore, Rodenbach's descriptions of Fuller's work also point to how powerfully affective the combination of all the agential elements were to the overall performance event. As Garelick explains, "Fuller's performance forces the spectator to acknowledge the three-dimensionality of space, not only by creating the ephemeral shapes with her robes but by doing it so violently that the surrounding air suffers permanent damage" (164). Fuller's extension of her body through the sonic explosions, flowing costumes, and kaleidoscope lighting allows us to question whether gender plays a role in each of these individual mechanisms. In the entanglement of multiple agents that create a visceral experience, the performance work depends on Fuller's embodied and particularly feminine display of fire, engulfing the audience and spreading rapidly throughout the space.

Another strategy to subvert stereotypical renderings of gender was Fuller's use of hysteria in movement to render a different understanding of her own female body in performance. "Hysteria can be reclaimed," writes LaCoss, as a "'pre-political manifestation of feminism' that rose up against the normative authority of the patriarchal social order" (2005, 39). In "The 'Symptomatic Act' circa 1900: Hysteria, Hypnosis, Electricity, Dance", Felicia McCarren argues that Fuller's work "confronts medical stereotypes of the hysterical body and the cultural conception of femininity it subtends…. It points to a different way of reading the body's language" (1995, 751-752). Hysteria was a component of the modern era's fascination with the (female) body and part of Armstrong's idea of the clarification of the body. McCarren[xxiii] links dance and hysteria together for a "deeper consideration of how visuality works onstage and in the clinic at a particular historical moment: what the audience and the clinicians look at and what they see" (750). From her movements on stage to the use of her technology, Fuller consistently shifted binary notions of subjectivity through her feminist-inclined embodied practice and the entanglement of agencies in her performance act.

The hysterical body was always part of Fuller's repertoire. She created her first performance the *Serpentine Dance* based on her previous role as a hypnotized patient (Figure 2). In "Poet and Dancer Before Diaghilev," British literary critic Frank Kermode argues, "her very ignorance of classical technique was to contribute, with the hypnotic attitudes, the resemblances to natural objects, and the optical illusions, to her establishment as a living emblem of a new aesthetic" (1976, 33). Fuller's hypnotic dance with the inclusion of technology was to become her signature act.

Occurring at the same time, French neurologist Jean-Martin Charcot attempted to cure the medical diagnosis and highly gendered disease of hysteria through the means of hypnosis and electricity. Fuller's work utilizes these same tools by using "technology to heighten the psychological effects of her art" (Merwin 1998, 74). Charcot relates his process to that of a photographer, registering only what he sees. When McCarren critical looks at his methods of observation and treatments, another narrative exists in opposition, as she argues, "Charcot's insistence on the visuality and theatricality of hysteria belie his neuropathological efforts to locate its physiological and psychological roots inside the body" (1995, 750). The problematic situation surrounding visual technological devices like photography or the camera is how the operators (mostly male bodies) do objectify and exhibit (mostly female bodies) as the controllers

of such apparati. Charcot literally displayed his female patients at lectures, demonstrations, and more as passive objects in his application of electricity to control their bodily movements.

In comparison to Charcot's use of electricity to "diffuse the power of the hysterical spectacle and putting its control into medical hands," Fuller's use of electricity shifts notions of power by acknowledging what role each agent plays (including her own subjectivity) in producing an enactment both on and offstage (764). In two particular *spacetimematterings*, Fuller answered the questions how different contexts changes the dynamics of power and how agents create particular relations by her different experiences at the gym and on the stage. She discusses an experience where electricity was applied to her body at a Swedish gymnasium. After much hesitation, a female member of staff convinced Fuller to try out the machine for the archduchess and court ladies. Fuller recalls, "I returned to the machines, and had my back messaged [by electrical vibrations], in order that the noble company might look at me…as they would survey an interesting animal…I never turned my eyes away from them…I was therefore, as much amused by them, and without their perceiving it, as they were amused by me" (1915, 170).

In the venue of the gymnasium, the court ladies and staff member placed Fuller in a compromised position, in which she had no control over the apparatuses, the environment, or the viewers; she could only stare back. Her position was that of an observed object akin to an animal show. In this moment, "the application of electricity to the body cuts through its metaphoric productions, imposing a physical reaction that shorts out the body's capacities for representation," the situation rendered her powerless and forced her to perform (McCarren 1995, 764). In comparison to her performance works, the entanglement of multiple agencies allows "the subject the freedom" in an "electrified space" (Ibid.). In contrast to Charcot who controls the technology to direct the spectacle of hypnosis and who maintains his agency and power over his patients, Fuller diffuses agency amongst all the different elements, including her body, as the power of her enactment is in the fluid traffic across the human-non-human boundaries by the aesthetic representation of her self in performance.

If Charcot was unaware of his own actions and the residual effects, Fuller clearly was. From her first performance in New York, she embodied the possibilities afforded by technological apparatuses, relentlessly training her body to become a projected screen with outstanding effects (Figure 5). Even within the descriptions of her "Mechanism for the

Production of Stage Effects," the patent states, "It will now be seen that the figure of the dancer, clothed preferably in white or some color sufficiently contrasting with the color of the scene, standing on a plaque on top of the pedestal, will appear to be mysteriously suspended in the air" (U.S. Patent No. 513102, 1894). With her expertise and knowledge of her own moving body immersed in her own technical invention, she seemingly suspended herself in mid-air on stage, a task still not easy to accomplish today.

The effect created by her technologically mediated body overwhelmed the audience, causing an array of sensations, from shock to disbelief. For French symbolist poet Mallarmé, Fuller was the epitome of the ideal dancer. The fluidity of her movements in light and fabric, as he states, "enlarged by ordered or tempestuous contradictory flights, circling, magnifies [the image of flames] until dissolution: a central nothingness, all volition, for everything obeys a fleeting impulse to disappear in whirls" (1897, quoted in Frankenbach 2015, 146). Fuller hypnotized her audience, challenged the subject/object roles, and denied objectification of her body through her stagecraft techniques of her moving body in the electric space of feminine-themed landscapes. Her performances accounted for how all the different agents (technical apparatuses, space, costumes) acted and affected herself and the audience as well.

Fuller and Technology

Despite her success in the performance works, within this time period, newspaper articles never mention her role in technology. Instead, journalists and critics emphasize the sheer number of electricians needed to create the works, maintaining her position as a machine instead of as creative inventor. Fuller's *Fire Scene* from *Salome* "will require fifteen men to handle the electrical and other effects necessary for the presentation of this novelty" ('The Fire Scene' 1895). An 1896 review of an evening performance at Koster & Bial's Music Hall covers her latest Paris dances "La Nuit, La Feau, La Danse Blanche, Le Firmament, and Le Lys de Nile". The report states Fuller is not "remarkable" or innovative, but "rather more than ordinarily intelligent in these different roles" (1896, 5). They continue, "In the first ten minutes it became evident that 'La Loïe' is more skillfull…her movements have become, if not quite graceful, yet much more pleasing than they used to be, and most especially of all, that she has secured the services of an exceedingly clever electrician" (Ibid.).

Newspaper critics described her works as being "marvelously beautiful spectacles," attributing the success to her elections (Ibid.). The writers incorrectly credit the electricians, questioning her ability to use, design, and stage technology. Additionally, her work attained famed stature because of the technology in which the critics write Fuller out of the involvement with electricity and with creating the desired effects. The previous day's article adds, "her mother and her two brothers, Burt and Frank, who look after the lighting mechanism of her performances" came along ('Loïe Fuller is Here' 1896, 10). In her performance works, it would seem the reviews deny Fuller's role as innovator or user of these technical apparatuses.

The reviews also deny her technical ability, associating all the electrical aspects to Fuller's male help, thus positioning her as an "effective piece of mechanism" instead of her role as innovator (Hawthorne 1859, 48). Perhaps the absence of attention to Fuller's possible role as a technological innovator may be linked to the Victorian period's constructions of gender. In an 1893 article on her presentation of the *Serpentine* dance, her manager J.M. Hill recalls, "Miss Fuller will appear at the Standard Theatre at 10:30 PM…Workmen are now cutting through the stage to arrange new mechanical appliances which will enable her to present startling effects never before presented by her or witnessed by an American audience. Stereopticons are to be used and the dancer duplicated upon the stage. I intend to present Loïe to my audiences just as she appeared in Paris" ('Loïe Has Changed Her Mind' 1893). Hill not only possessively presents Fuller as his own spectacular object to display, but also uses the passive voice to subordinate her importance to the workmen and the technology that creates these "startling" effects. Modeling the gender relations of his time, he does not acknowledge her position as a creator, but merely a user of technology, requiring the aid of her brothers and their electricians to perform her dances.

More recent scholarly and biographical sources on Fuller's work with electricity, however, create an entirely different picture. Garelick argues for Fuller's pioneering technical role, as her "inventions" enhanced her reputation as an "unknowable wizard with mysterious powers" (2007, 34). Fuller was cautious about others copying her innovations to such an extent that she trusted only her brothers to lead her own independent crew of electricians when they toured. As Garelick continues, they "traveled everywhere with her and were sworn to secrecy about their techniques. Fuller even refused to commit her lighting cues to paper" (Ibid.). As one of her managers M. Marchand states, "She is always rehearsing with her electric apparatus,

engaged in search of new effects, and she sometimes keeps her electricians at work until six o'clock in the morning" (Fuller 1913, 258).

In 1997, Marcia and Richard Current, biographers of Fuller, stated that "Loïe and Frank together designed the new and more elaborate lighting system" that her dances required, attributing ingenuity to both her and her brother (96). It was certainly true that Fuller was active in designing new lighting techniques and training her electricians. The reviews in her own time, however, state that she was not in charge of these developments as that responsibility was incorrectly bestowed to the electricians on hand, perhaps more telling of the time period and of the role of women.

Even if she was being denied by public acknowledgment for her innovation and expertise in using technology, Fuller still attempted to regain ownership by copyright protection over the entirety of her choreographic works. In one of the earliest cases of copyright infringement in dance in 1892, Lois Fuller filed a lawsuit against New York City chorus girl Minnie Renwood Bemis, who was performing a version of her *Serpentine Dance*. In the New York Circuit Court, Judge Lacombe dismissed the case in 1892 and denied Fuller copyright protection "because of its lack of 'narrative' or dramatic content", stating:

> It is essential to such a composition that it should tell some story. The plot may be simple. It may be but the narrative or representation of a single transaction; but it must repeat or mimic some action, speech, emotion, passion, or character, real or imaginary. And when it does, it is the ideas thus expressed which become subject of copyright. An examination of the description of the complainant's dance, as filed for copyright, shows that the end sought for and accomplished was solely the devising of a series of graceful movements, combined with an attractive arrangement of drapery, lights, and shadows, telling no story, portraying no character, depicting no emotion. The merely mechanical movements by which effects are produced on the stage are not subjects of copyright where they convey no ideas whose arrangement makes up a dramatic composition. Surely, those described and practiced here convey, and were devised to convey, to the spectator, no other idea than that a comely woman is illustrating the poetry of motion in a singularly graceful fashion. Such an idea may be pleasing, but it can hardly be called dramatic. Motion . . . denied (quoted in Picart 2012, 691).

From this case, the judge's opinion in the delineation of denying dance or any choreographic works copyright protection served as legal precedent for years to come. The lack of narrative or dramatic content was indeed a disruption of the balletic formula, a creation of abstraction that preceded the elaboration of this key element in modern to post-modern dance.

There were additional issues at stake within this decision for dance and for Fuller. On the one hand, the difficult matter of copyrighting dancing has to do with the uniqueness of the choreography stemming from a particular dancing body. What occurs, then, when this dance is disembodied from the originator and represented by some other body? On the other hand, Fuller recognized her position as a white woman in which the ability to gain public credit over her work and to obtain status and wealth depended on copyright protection. Due to this uneasy situation, "her case thus raises questions about what bearing liveness had on white women's relationship to commodification on the one hand and possessive individualism on the other" (Kraut 2015, 49). Furthermore, the supposed lack of narrative elements in Fuller's non-dramatic dance foregrounds her work as an avant-garde artist, mirroring Villiers and the Symbolist movement's values of stasis and the symbolic image over story-telling. She was ahead of her time in creating dance performances, but was continually denied by copyright cases. Additionally, newspaper critics continually discredited her technical production and innovation. Due to these disappointments, Fuller began the process of obtaining patents for her technological achievements for some control over her creative property.

Given her patents, it is clear that that level of technology in Fuller's performances was spectacular. Fuller had three U.S. Patents[xxiv] that included "Garment for Dancers" No.518347, "Mechanism for the Production of Stage Effects" No.513102, and "Theatrical Stage Mechanism" No.533167 (Figure 6, 7, and 8) for altering scenography and costume developments. As Kraut clarifies, "This switch in strategy – pursuing property rights in her scientific inventions rather than in her artistic work – adds another wrinkle to Fuller's vexed relationship to propertied subjecthood" (2015, 80-81). Throughout Fuller's life, she was determined to elevate her status and to be taken serious as an artist. If she was not able to secure copyright protection for her performance works, her patents secured her position as innovator, granting legal and economic benefits for her technical devices. Kraut argues that in "seeking a way to navigate the patriarchal organization of the mixed-race commercial stage, Fuller strove to position herself as a propertied subject and thereby take hold of racial prerogatives typically reserved for white men" (Ibid.). Despite public opinion discrediting her abilities and legal institutions denying her copyright protection, her patents provided some proof of her technical expertise and innovation.

Fuller and Dance

With her difficulties in copyrighting movement and amidst a field dominated by ballet, Fuller's relationship with dance was quite complex. In contrast to large-scale ballet productions housed in opera houses, her connection to dancing was situated more in "low art" venues. Despite her commercial success, reviewers and critics did not consider her work within the dance canon, partly due to the fact that she performed in cabarets. In regards to her technique, she is situated within in the canon of modern dance, developed in opposition to ballet, where choreographers, in particular, "saw the machine as a liberating force for opening up the possibilities of a dancing body" (Salter 2010, 228). Fuller's movement came from understanding how she could move her body to manifest the properties of the technical apparatuses (pole devices sewn into her fabric, lighting effects, music, and the stage design). As dance scholar Ann Cooper Albright argues "Fuller's dancing was, in fact, kinesethetically expressive," emphasized by the " central torque in her body to launch her silks" (2007, 182). Dance was one medium in a slew of different elements all fused together to create her artistic performances (Figure 9).

Eventually, Fuller began her own female dance troupe that focused her creative process on the body. Her teaching style reveals her efforts to "tap into some kind of instinctual movement and expression" in each of her young girls (Garelick 2007, 175). If one of the girls was pigeon-toed, she should dance with her feet inward, expressing a want to celebrate the "'dancing that suits the pupil…The so-called 'faults' [of movement or posture], when understood, are frequently just the things most worthy of development,' Fuller told a journalist" (175-176). In adapting a non-hierarchal, collaborative creative process within her company, Fuller's ability to incorporate her students' bodily limitations or failures and to develop these movements in her performance was quite forward thinking.

In her work *La Mer* (1925), for example, "Fuller's giant veil technique reached its apotheosis…[she] draped 4000 square meters of iridescent silk taffeta over the staircase of the Paris's Grand Palais…Fuller's army of 75 dancers stood on the staircase...under the silk, [they] stimulated the rhythmic undulations of the ocean [while] Fuller employed rotating light projectors…changing 'sea' tones of green and blue over the fabric" (182-183). Fuller accomplished a remarkable feat: she was not only able to depart from the traditional set up of the stage and in such a grand venue, she also was able to create her own aesthetic larger than life,

surmounting that of the human scale. In accordance with Symbolist aesthetics, Fuller depersonalized the female dancers' bodies to embody the natural element of water.

Fuller's art, particularly *Fire Dance*, illustrates a key socio-technological shift of gender within technologically augmented dance performance. Fuller invented and mastered new technologies in light, stagecraft, and costumes informed by the movement of her body. Her works intermingled the cultural movements of Modernism, Surrealism, Symbolism, and Futurism[xxv], developing specific traits of each to mythologize and imagine. Fuller and her art never fit into one category well, hence the difficulty of placing her into any one historical thread. She was a "New Women", creative and independent, but also extremely sexual by way of an emotive expression in her art, a strategy of empowerment against confining, traditional gendered structures. Expressing and complicating notions of femininity, her performances reworked the hysterical female body and disoriented the spectator's gaze through motion (Figure 10). In the act of her dancing body, she created an intra-active performance event, a fluidity of agents and their materiality.

Manifestos to Movement: *Valentine de Saint-Point*

Loïe Fuller was not alone in challenging the figuration of the human-machine relation in this period. The work of French artist Valentine de Saint-Point and further along Italian Giannina Censi faced similar negotiations in the terrain of Futurism. They all employed similar strategies in their performance work by their embodiment of electric machinery through bodily movement. Valentine de Saint-Point battled [conventional] notions of femininity by moving between the mediums of writing and movement to create her dance performances. Beginning her career in writing, Saint-Point published a volume of poems around 1905 entitled *Poémes de la mer et du soleil*. She was active in the Parisian scene, diving into multiple artistic practices including painting, sculpture, playwriting, and dancing. When joining the 'Group de l'Abbaye', she was introduced to Marinetti, who took an interest in her poems. Supposedly Marinetti convinced her to join the Futurist movement and "solicited her to write the Manifesto of Futurist Women" (Berghaus and Saint-Point 1993, 27-29). In 1909, Marinetti wrote the famed Manifesto of Futurism in which the message was "destructive and reactionary, and denigrated women" (Dixon

2007, 48). Saint-Point's manifesto was "presented as an answer to Marinetti's infamous call for the 'scorn of woman'"(Scuriatti 2007, 11-12).

Despite misogynistic tendencies in Marinetti's manifesto, he gave women a "voice offering them relatively prominent positions within the movement as women's emancipation was 'compatible' with the Futurist aims of "modernity, activism, and anti-authoritarianism" (139). Saint-Point presented work at Futurist events and published three additional manifestos in 1913: The Theater of the Woman, Futurist Manifesto of Lust, and La Métachorie. The latter manifesto outlined her philosophy of dance using a term meaning "beyond the chorus," (aka beyond dance) (Satin 1990, 3). She focused on the cerebral nature of performance to unite all of the arts (music, dance, poetry, sculpture, painting). After leaving the Futurists in 1914, she continued to perform, to write poetry and novels and even became engaged in political activism in Cairo until her death in 1953.

In 1917, she traveled to New York City to present her dance, Festival de la Métachorie: Poemes-Drames-Ideistes de Valentine de Saint-Point, at the Metropolitan Opera House. In her manifestos, an "expression still regarded as a masculine polemical mode" to movement, Saint-Point most clearly embodies the paradoxical position of modernist women (Lusty 2008, 246). Her identity, writing, and performance art were all sites of struggle for female subjectivity. As her manifestos informed her performance practice, it is important to examine the central ideas in her written texts.

In the "Manifesto of Futurist Women," Saint-Point promotes a vision of an independent woman that equates sexual desire with strength, but forecloses female agency by ultimately restricting woman's role to motherhood. Saint-Point boldly ends her manifesto with a rallying cry to women, "You owe your humanity heroes. Make them!" (1912). In her strong commitment to sexual desire, she mirrors Fuller. But Saint-Point occupies a contradictory stance between nature (by association to natural elements, biological functions, sexual desires, and instincts) and also culture[xxvi] (as an object for male desires).

Through her writings, it is clear she promoted women's sensual experiences as equal to male strength, inspired by "New Women" ideologies. However, she remained caught in the fascist ideal of motherhood, though she never had children herself. Hence, she departed from the Futurist and fascist web of paradoxes to enter into the realm of dance performance. As a poet, performer, and choreographer, she was able to promote another side of female identity

previously suppressed: rational and abstract thought. With an insistence on creating a cerebral practice (not unfamiliar to male choreographers), her dances were also scored, reflecting mathematical logic in her choreographic process. As Fuller intervened in creating the technology, Saint-Point interfered with writing and the equivalent practice of notation. Inspired by Symbolism, she connected to geometric shapes projected in the performance space and mimicked in her movements.

In her manifesto entitled The Theater of the Woman, Saint-Point calls for a woman to represent herself on stage as one "who has thought, a will…a woman who knows who she is, what she wants, what she does; who controls her life instead of submitting to it…who finally is the free and conscious woman, and yet very feminine" (1913, quoted in Satin 1990, 5). Her manifestos end up supporting patriarchal, fascist aims, arguing for women to enter into motherhood. Within the male dominant socio-political and technical climate, her writings reveal her own struggle for social, political, and artistic freedom. Her move to dance performance perhaps was an attempt then to rethink agency and materiality, at least on the stage, apart from the sexist objectives of Futurism and fascism.

The work Festival de la Métachorie typifies Saint-Point's shift of the typical relationship between bodies and technology, complicating female subjectivity and creating a new milieu. In a combination of Symbolist and Futurist qualities, she divided her performances into four different categories based on her poems: love, irony, pantheism, and war. Her Métachorie Dances "sought to translate her poetry into the physical language of the moving body" (Berghaus and Saint-Point 1993, 31). Her poems were recited from the orchestra pit where her movement commentated on "the deeper meaning hidden behind the words" (Ibid., 35). Exotic fragrances spread throughout the theater hall. She performed to the music of Roland Manuel, Rudyard Chennevière, Claude Debussy, and Maurice Droeghmans in front of "large cloth screens lit with color, and other walls onto which mathematical equations were projected" (Satin 1990, 8). The backdrop of "bizarre, luminous shapes reflected her geometric quality of her moves…the steps are brisk and powerful, using elements such as pushing, sprawling, crawling, running, flying, [and] kicking" (Berghaus and Saint-Point 1993, 31-36). In a similar aesthetic to Fuller, she also wanted to abstract the dancing body and accomplished this by keeping her face veiled (Figure 11) to depart from emotion and reveal "only the essential lines of movement and rhythm" (Satin 1990, 4). She departed from an individual persona to enact an entanglement of different agents by her use of

materials, including movement, sound, text, scents, and more. Saint-Point's performance was a completely immersive, sensorial experience of dance performance.

Furthermore, in her writing and performance, she embodied both the endless balancing act between binaries. In the actual act of her performance, in "doing," binary "categories are resolved", Tim Armstrong states, for the "body which acts and has consequences cannot be seen in dualistic terms, it works on a world which is neither entirely nature or culture" (1998, 50). Her performance particularly stands out as a new milieu, incorporating multiple senses and practices into one experience and combining qualities from both mind and body. She challenged the objectified position of female bodies and subjectivity through her creative practices in writing and dancing.

Dancing in Flight: **Giannina Censi**

When Valentine de Saint-Point left the Futurist movement in 1914, another rising dancer that embodied the Futurist's agenda of forward progression in technology took her place. Milan-born dancer and choreographer Giannina Censi (1913-1995) also demonstrated Marinetti's machine-body vision in her Aerodanze performance in 1931. Censi trained at La Scala, a ballet school in Milan based in the Cecchetti ballet method . She was sought out by Marinetti to put into movement his ideas from the Futurist Manifesto of Dance (1917). Although classically trained, she earned her living by performing in both ballet and popular productions. In embodying that of an airplane in motion, Censi's performance shifted both understandings of Futurist's representational practices and technologies of gender.

In the Futurist Manifesto of Dance, Marinetti outlined three different dances, Dance of the Shrapnel, Dance of the Machine-gun, and Dance of the Aviator, in which he envisions a female dancer performing "the fusion of the human body and the machines of war" aligned with the most innovative technologies after World War I (Klöck 1999, 399). He describes how the dancer "should imitate or stimulate the dynamics, sounds and operation of such machines…how the experience of technological apparati should be interiorized and exteriorized" (Ibid.).

Marinetti explicitly calls for a female-gendered body, perhaps presenting a shift "away from the belief that women belonged to the paradigm of nature…into the futurist epoch; it also acknowledges a women's potential of 'preparing' and possibly bringing about the 'fusion of man

and machine'" (400). In a different perspective, this could be seen as equating female bodies with technologies for men, like Marinetti, to control and dominate. Women were 'bodies in motion', exemplifying Marinetti's vision of the body-machine paradigm. Additionally, this manifesto was written after the performance of Saint-Point. Marinetti might have hoped to recruit her, but was unsuccessful as she left the movement.

Another factor in the shift of the Futurists' practice was the rise of fascism. The political regime of fascism claimed themselves to be more revolutionary than any other movement. From the beginning, the Futurists aligned themselves with any technology; shifting to the airplane more specifically was a strategy to maintain visibility in their political regime. As Klöck describes, "the airplane was the only machine that both belonged to the iconography of fascism and that had also always been part of the futurist paradigm" (1999, 407).

At the gallery of Lino Pesaro in Milan, Censi performed Aerodanze on October 31, 1931, amidst a poetry contest organized by the Futurists (Figure 12). Her dance was an interpretation of Marinetti's two aerial poems, spoken aloud, and Enrico Prampolini's five aerial paintings, hanging in the space. Censi danced with barefeet and no music, recalling, "I launched this idea of the aerial-futurist poetry…everything that the plane did had to be expressed by my body. It flew and, moreover, it gave the impression of these wings that trembled, of the apparatus that trembled…And the face had to express what the pilot felt" (400).

Censi launched the Futurist vision into representational practice, bringing the "image of the machine to bear on the organic and expressive human body" (Salter 2010, 228). Her dancing body mimicked that of the airplane, the newest machine, performed on stage. In "Torque: The New Kinaesthetic of the Twentieth Century," historian Hillel Schwartz suggests that with the advent of airplanes came a new kinesthetic motion modeled in torsion, mimicking the spiral action of the plane. This new release of the torso was also a "spiritual release as well…emotion and movement were to be intrinsically related...expressive and operative" (1992, 75-77). As with Fuller's departure from ballet and movement enumerating from the central torque of the body, Censi's performance also paired "expressive and operative" movement by replicating the motion of the airplane.

Unlike both Fuller and Saint-Point, Censi had a background in ballet in which her colleagues gave her quite harsh feedback after her performance. They stated that they "did not understand why I was so content with miming the flight of an airplane, they said that I could

have done better" (Klöck 1999, 411). This reaction was desirable for the Futurists, intent on always disrupting the traditional systems of institutions. Their commentary is a bit ambiguous, indicating a need for a more critical analysis on what her movement qualities and shapes actually consisted of through comparison to other performances or through her teaching style[xxvii]. In one commentary about her movement, Censi's body "never settles down in an image, but 'moves in a poly-centric space that changes continuously, at least in her imagination'" (Ibid.). In mimicking movements of the plane and constantly evolving into different shapes, like Fuller and Saint-Point, Censi's performance departs from the stereotypical renderings of female bodies on stage to a more fluid entanglement of agency and materiality.

Modern dance and the kinesthetic motion of torsion depend on one core located in the center of the body, not multiple or shifting centers that are not even realized. It is not clear if Censi had physically training outside of ballet. She did have practical experience in planes, though never piloted one. She "joined flight-acrobats like Mario De Bernardi during his aerial stunts in order to internalize the vibrations and the velocity of the plane" and her Aunt Rosina Ferrario was the "first Italian woman to receive a pilot's license" (408). Nonetheless, her personal experience in flight and relationship with pilots provided her with the information necessary to embody both sentiments and motions of a plane. Additionally, Censi was able to challenge the fascist ideal of "Woman" as a female performer evoking a fusion of the body with the machine.

Despite the fascist ideal of women as wife and mother, the everyday woman did not necessarily fit into this mold. For example, in the 1920s there was an increase in women aviators, including Gaby Angelini and Carina Negrone Di Cambiaso, who made "national and international headlines with their records" (407). In 1933, Censi's dances entered into the discourse of women's physical health and education. The hygienist and physical therapist G. Poggi-Longostrevi placed images of Censi's movements from Aerodanze as examples of "how, when, and why women should use and train their bodies in the service of the fatherland" (412). Censi was not creating techniques of the body to train woman for motherhood. Her own interpretation freed movement from the constraints of ballet and fascism. Censi's Futurist representational practice disrupted fascist structures from the inside, perhaps unknowingly, encouraging other women to rebel as well.

Censi marked a key technological shift by embodying the sensations and movements of an airplane through her own choreography. Her training in ballet, coupled with the embodiment of a technological aesthetic proposed by Marinetti, perhaps upheld conventional modes of the relation between human and machine. But her own creative interpretation made it unique and powerful by adding emotion and expressiveness to hard metal. Furthermore, within the fascist regime, she disrupted the prescribed role of women as mothers not only by not having children, but also by aligning herself more to the "New Woman" ideology— she maintained a creative, artistic career her whole life.

Conclusion

Fuller, Saint-Point and Censi all shifted stereotypical renderings of femininity in their kinesthetic art practices by way of different technologies and techniques. Moreover, in each of their performance works, each woman created an entanglement of agency and materiality, displacing the typical auteur position to create different figurations of the female self through sound, text, lights, music, costumes, and stage design. Fuller invented new technological devices informed by her body to embody modernist interpretations of natural imagery. Her paradoxical position of her on and off stage persona complicated human constructs of agency by creating new figurations of subjectivity. Similarly, Saint-Point utilized technology through projections and incorporated multiple stimuli in her performance practice to create a new milieu of artistic expression. While not deploying technical apparati, Censi nonetheless embodied machinery, blurring boundaries between the body and machine by attuning to emotions and sensations in her performances. She disrupted fascist aims for women within the system itself.

All three artists intertwined different political and cultural movements. At times, they promoted traditional structures of power or challenged patriarchal systems by their artistic practice, revealing the difficulty of their situation as creative, independent, career-driven white women in between the World Wars. Wosk writes: "At the end of the nineteenth century…there was also cultural ambivalence in depictions of the New Woman of the 1920s – images of the modern emancipated female were still invested with cultural conceptions of femininity, which included sexuality, beauty, and sociability. Women themselves had their own ambivalence about reconciling 'emancipation and traditional femininity'" (Wosk 2015, 108). Thus, these female

artists through their art practices changed preconceived notions of what it meant to be a woman, shifting dynamics of power on the stage and in their lives.

Historical masculine interpretations of technology and the body in modernist texts contain traces of anxiety and fear, resulting in the "positioning of cyborg figures as feminized others" (Parker-Starbuck 2011, 17). Men controlled and intervened with and upon female bodies, mapped unto the machines themselves. They also created movement techniques influenced by how the machine could inform bodily practices. At the same time, narratives surrounding reproductive technologies and motherhood promoted male mastery over technology and women to dutifully respond to the war efforts by giving birth.

Fuller, Saint-Point, and Censi disrupted these notions, reclaiming their roles in different ways. All focused on how the body can alter technologies and techniques, creating an embodied act of different agencies. When marginalized others (like these artists) defined their own subjectivity, they created a new opening for viewing the agency of matter. Technology and the surrounding actants of scenography, space, audience, and more, emerged as materials and subjects with their own effects and behaviors on others. Indeed, the very idea of the female machine in Fuller, Saint-Point and Censi's work birthed the ability to see technology as having agency in its own right.

All three female artists presaged the liberatory aspects of the figure of the cyborg. In their unique way of combining attributes of the Futurists and Symbolists movements with dance, they allowed a refashioning of embodiment away from essentialized gender binaries, even as ideological structures worked to re-secure those binaries within machinic bodies. In recent times, while all three artists are still placed within the margins of different fields, their stories echo across disciplinary and corporeal boundaries.

Chapter 2: Analog Era: From weaving rope to dancing objects: Yvonne Rainer's *Carriage Discreteness* from *9 Evenings*

Yvonne Rainer's *Carriage Discreteness*

Black out. The stage lights begin to dim up slowly. In the first set of sequences, Yvonne Rainer instructs Mike Kirby to take the Styrofoam beam to section twelve, Ed Iverson to take a mattress to section five, Rosemarie Castoro to pick up a plywood slab and make a bee line for section eleven, and the directions continue (Figure 14). *She divides the space into twenty sections with chalk, clustering the everyday and technical objects together based on their shared characteristics of weight, size, materials, and functions*[xxviii]*. In parallel to the performers' actions, technological objects move around the space in the second sequence that include remote-controlled sculptural forms like the creation of a transparent ball running down from the ceiling, luminous rods, and two films (Jimmy Cagney, W.C. Fields) playing at the back of the stage with all equipment visible to the audience*[xxix]*. Rainer dispatches instructions to her performers through walkie-talkies from a balcony, telling them to conduct generic tasks with various stage props and asking the engineer Per Biorn to activate the technological components that were programmed within a 67-step trigger system entitled TEEM*[xxx]*, the Theatre Environmental Modular Electronic, essentially a switchboard device to control different functions* (Figure 15). *Each action occurs individually, where all other elements pause until called upon. Eventually, the taxonomy of the system becomes more chaotic as the dancers continue to move objects around, and as the technical objects disrupt and collapse upon the human movements. The only time the two series of events merge between the performers and technical objects is when a floodlight switches briefly on as Steve Paxton launches from the balcony on a fifty-foot swing towards the audience, a possible nod to space imagery. The performance ends.*

9 Evenings Event

From October 13-23, 1966, a groundbreaking performance event merging art and technology took place at The Regiment Armory in New York, NY. Artist Robert Rauschenberg

and engineer Billy Klüver organized the event consisting of ten artists (John Cage, Lucinda Childs, Öyvind Fahlström, Alex Hay, Deborah Hay, Steve Paxton, Yvonne Rainer, Robert Rauschenberg, David Tudor and Robert Whitman) collaborating with thirty engineers from Bell Laboratories in Murray Hills, New Jersey (Figure 13). For Klüver, the goal of the event came from an interest in bringing artists and engineers together to see what role technology could play in the development of artistic creation (Morris 2006, 9).

Art historian Meredith Morse describes Klüver as someone who "passionately believed that art had a role in humanizing technology. In Klüver's words, 'artists had the intellectual freedom and sense of personal responsibility which could shape the new technology for the benefit of the individual'"(Morse 2007, 3). In an event that not only attempted to create new technology, but also foster new ways to collaborate productively and efficiently, Klüver's comment redirects the emphasis upon the artists to produce such utopic visions. In reflecting back on these works, what was the perspective and ultimate aim for both the artists and engineers? What effect did technology have on the process, the creators and users, and, in the final performance, on the audience? How did the work engage with gendered patterns in the context of technology and performance?

In 2006, two major retrospective events took place to commemorate *9 Evenings*' 40th Anniversary. The first was a major research residence at the Daniel Langlois Foundation in Montreal by art curator and researcher Clarisse Bardiot. Bardiot created an archival webpage and conference event around *9 Evenings*, evolving from the numerous diagrams that were published in the program. She describes *9 Evenings* as "an overarching electronic environment, a network that would connect the *technical* devices involved in the performances, an interface between the technical apparatus and the performers and engineers" (my emphasis, Bardiot 2006, 50-51). The second was an exhibition presented at the Massachusetts Institute of Technology's List Visual Arts Center in Cambridge, MA in May 2006 curated by Catherine Morris. The exhibition offered a "fresh look" at the performance events where "collaborations presaged the many hybrid art/technology efforts" of today (2006, 6).

In recent analyses of *9 Evenings*, numerous scholars have discussed collaborations between engineers and artists, the dichotomy between art and science, the role of technology, and, in particular, the focus and effect of sound (Bardiot 2006; Morris and Favor 2006; Dyson 2006; Garwood 2007; Oppenheimer 2011). In most of these analyses, however, the main focus

remains directed at the technology used while the significance of the gendered body (or any body at all) is left out. In fact, scholar Frances Dyson is one of the only researchers to briefly mention some of the gender dynamics and the resulting consequences had on the process and the production of the works.

This focus on technology (and on the prevalent incidences of technical failures) occluded the difficulties some of the artists faced in working with the engineers themselves. Female choreographers Yvonne Rainer and Deborah Hay, whose works both dealt with remote controlled apparatuses, were the most critical about their experiences working with technology. When Alfons Schilling in 1966 interviewed Rainer, he commented, "'I have the feeling that you didn't make the piece because of technology, but in spite of technology." Rainer replied, 'I have that feeling, too; probably the only really essential aspect of the technology that I used was the walkie-talkies, [which] in a way wasn't essential'" (Dyson 2006, 12).

In another instance, Alex Hay explicitly mentioned gender, stating "The kind of materials and engineering equipment [involved were] very masculine… It was a revolutionary thing, it didn't just evolve" (Ibid.). For Deborah Hay, the experience working with engineers and technology was "so traumatic that she was unable to work afterwards" (Ibid.). Between 1972 and 1975, Rainer left her role as choreographer and performer in the dance world and shifted her artistic focus to making films. She did not return to dance until twenty-five years later.

Although the collaborations with engineers might have been difficult in the process, the performance works provide the possibility for another story. I argue here that Yvonne Rainer's work *Carriage Discreteness* can be understood as a successful artistic intervention into queering technology and dance. This is not to pretend that problematic binaries between male/female, man/machine, mind/body did not exist in the context of this time, but rather to highlight how the performance platform offers an alternative method to radically question these bonds. Similarly, Deborah Hay and Lucinda Childs, as the other female artists of *9 Evenings*, created strategies within their own works to also address problematic notions of technological fetishism and objectification.

After the Second World War, ideologies (and reality) shifted around issues of power, technology, and gender. Feminist political movements, nestled sometimes uneasily in the larger social revolutions of the 1960s, put into perspective Rainer's position, "as a white, unconsciously ambitious artist, oblivious to art world sexism and racism and ensconced in dancing (a socially

acceptable female pursuit)" (2006, 386). In this socio-technical climate, the trope of the female machine continued, but a tension was stirring as ambivalence grew in the unknown territory of computational machinery.

To understand all the dynamics at play in Rainer's artistic work with engineer Per Biorn and the larger *9 Evenings* event, I unpack the particular situation of women within the context of early computational machinery and the Space Race. In this era, an impetus toward experimentation, a sense of ambivalence, and an emphasis on bodily awareness defined the realms of technology and of dance. Within this context, I see the work of Rainer's *Carriage Discreteness* touching upon the complexities that arise in collaborative projects, detailing how agency, materiality, and gendered subjectivity function differently in the research and development process compared to the performance event.

In the research and development phase of *9 Evenings*, the creative experimentation process was compromised in the name of technological development, which propagated specific gendered patterns and arrangements of power. In the performance event itself, the technical components became surrogate bodies alongside the everyday objects and performers, all decentralized agents in the act of movement in which matter became non-gendered. Despite Rainer's adverse reflections, *Carriage Discreteness* was successful in rejecting the domination of capitalist pressures, technology, and codified, large-production concert dance events[xxxi]. By using dance—and due to the art form's lack of representationalism and repetition—she went against profit-directed productions. Additionally, her focus on more task-based, pedestrian movements with an array of different performers counteracted traditional dance productions of codified techniques and virtuosic dancers in proscenium theaters. With technology, she disrupted notions of productivity and innovation.

As an artistic event with a strong cohort of female choreographers and dancers, *9 Evenings* acts to both exemplify the tensions and persistence of gendered relations to technology *and* critique those forms of labor. In order to discuss the shifting role of women in politics, engineering and computer science, and dance as it relates to *9 evenings*, I consider Second-wave feminism, the prominent female engineers and programmers involved in the creation of the ENIAC (Electronic Numerical Integrator and Computer), the first computational machine, and the Apollo Guidance computer— a navigation system created for the first space mission to the moon— and the female choreographers pivotal to the creation of modern to post-modern dance

techniques.

From Fictitious Female Machines to the Reality of "Female Computers" in the Age of the Space Race

In post-World War II, an expansion of capitalism and globalization emerged linking the world together by the strands of technology. Technological innovation dominated the Cold War culture, spawning a new era of technological fetishism and commodification—the Space Race. As seen previously, the spectacle of technology permeated the cultural imagination as something new, highly anticipated, and grandiose. But in the context of the 1960s, different tensions stirred around issues of power, technology, and gender.

As editor-in-chief of *Artforum* Michelle Kuo argues, a 'double movement' was occurring where "new models of cultural and aesthetic engagement were just as quickly co-opted by and in fact isomorphic with developments in capital" (2013, 270). In adapting Guy Debord's theorization of 'spectacle' and Fredric Jameson's ideas[xxxii] around this moment as a "release of untheorized new forces," Kuo states "sovereign forms of power become more mutable and flexible forces of *control*" (271). In the postwar era, strategies developed to maintain and enlarge aspects of control in all sectors of life. The increase in use and advancement of technology was key to this transformation of power "as both cause and effect" (Ibid.).

This tension offered a small window of time where new methods began to push back against the established and problematic structures of the past including stereotypical roles of gender. When women started entering the workforce during World War II, there was a demand within the field of computer programming for women with mathematics degrees to calculate tables or to translate instructions onto punched cards. On the one hand, within the early development of computational machines, despite its problematic military connections, the initial protocols of computational languages, designs, functions, and more were not codified or prescribed within a specific gender or culture; this is a key factor in how women were able to participate in and collaborate with this domain at the time. The materiality of early computation was based on a binary system. At first, this system operated on the electrical circuits' capabilities of turning on or off. Later on, and still in use today, the von Neumann Model's use of a series of 0's (off) and 1's (on) coded the functions of the

computer. Code is the language of the computer and the "only language that is executable, meaning that it is the first discourse that is materially affective" (Galloway 2004, 165). Code was not just executable language, as it derived meaning "only in relation to its environment - only to the extent that it defines, formulates, or disrupts environmental networks. Not only is it unconcerned with identity- human or otherwise - its existence is predicated on an explicit shift in focus away from identity and toward systems" (Miller 2012, 23). Previously in the application of electricity, there were clean delineations of the relations of power between technology and gendered bodies. In this moment, the effects of early computational machinery were yet to be fully developed and defined, and even so, the effect on gender was difficult to decipher, as computer code did not rely on any human identity to function.

In one particular project in the late 1960s that dealt with the dependability of code for larger systems to operate, the MIT Instrumentation Lab created the Apollo Guidance computer, a part of the navigation system used to orbit and land men on the moon. This project had a stake in humanity as opposed to the disregard of any form of identity in computational functionality. As MIT Director of STS David Mindell states, "what was special about this computer was people had to stake their lives on it…if this computer failed, if one of the circuits went bad, or crashed or had a bug at the wrong moment, people were going to die and that was really a first to put people's lives on the line with integrated circuits and hardware – no one had done that before" (*Moon machines:the navigation computer* 2008). For this project, Charles Stark Draper and his lab of astronauts and software engineers would meet and debate on the purpose and functionality of the computer. Memory was a problem (reaching only 72kb) and hardware was fragile and unreliable. For their computer system, they decided to use core rope memory. Mostly male managers sent the instructions for the computational functions to women in a factory who would literally weave the software code into rope memory (the copper rope was woven through magnetic cores to designate a binary '1' and around the core to designate a binary '0'). The concept of software was new and engineers basically created the conditions and functions as they were processing it (Figure 17). The end result was the successful return of Apollo 8 back down to earth.

On the other hand, in popular culture, fictitious female machines continually "embodied some of the cultural preoccupations of the period, not only equivocal attitudes about women with extraordinary abilities but also ambivalent attitudes about simulations, technology, and control"

(Wosk 2015, 96). In some prominent examples like *Bewitched* (1964-1972), *I Dream of Jeanie* (1965-1970) and *My Living Doll* (1964- 1965), female characters were imagined as witches, genies, female robots, androids, and more that both upheld stereotypical ideals of suburban American life, but also problematized issues of control, commodification, domesticity, and technology.

In particular, the character of Rhoda, a prototype robot actually named AF 709 built for the U.S. Air Force, in *My Living Doll* exemplifies the technological fascination in her design, but also the consistent rapport of male's domination over technology. The character of Bob Cummings as Dr. Bob McDonald activates and operates Rhoda by emergency control buttons mapped onto her back as beauty marks; she also has an additional "technological feature that men love […an] 'on and off' button" (Wosk 2015, 107). Inspired, motivated, and funded by military aims, female machines had technical prowess and magical powers beyond the control of anyone and anything, but, at the end of the day, men could still shut them down with the flip of a switch. Consistent with the electric era, fictitious female machines embodied the dialectic of the female empowerment movements occurring alongside the continuing fascination, anxiety, and fear of advancing technology.

In *9 Evenings*, the technological devices in Rainer's and others works depended on earlier computational developments and spoke to the muddling of roles of engineers/artists and male/female participants, rather than to the constraining imaginaries of feminine technological embodiment. For instance, in the 1940s at the University of Pennsylvania, primary engineers J. Presper Eckert and John W. Mauchly were developing a new electronic modular computer called the ENIAC (Electronic Numerical Integrator and Computer) to automate ballistic computations (Figure 16). Initially, six prominent women ran the programming for ENIAC: Kathleen McNulty, Francis Bilas, Betty Jean Jennings, Elizabeth (Betty) Snyder, Ruth Lichterman, and Maryln Wescoff. They were labeled the "female computers" or "computer girls" and are now known as the world's first computer programmers, although nearly 200 women contributed to the ENIAC project (Herbst 2008,14). The production of TEEM in *9 Evenings* was mirrored off of this device to wirelessly network all the different technical components of the artists' works with the male engineers programming and controlling the machine.

With the advent of the ENIAC, gendered implications set upon by historical precedents within the technical appearance itself continued. The ENIAC machine resembled the telephone

switchboard, a technology predominantly operated by women. Therefore, it made 'sense' to hire women for this lower-status occupation as machine operators as well. In doing so, programming became more akin to "handicraft than science, more feminine than masculine, more mechanical than intellectual" (Ensmenger 2010, 123). Programming was associated with lower end clerical work, hence why women were so widely accepted into this field as they were seen as a "cheap, compliant, and undemanding labor" (Ensmenger 2010, 47-48).

Similarly, the creation of the TEEM device within *the 9 Evenings* context fed the hostility that grew between the engineers and artists. The artists had lost control of their aesthetic creation and production, perceiving themselves as cheap labor for technological gain only. The Bell engineers had so many technological tasks that needed to be done that artists fulfilled these requests as "unskilled laborers,"[xxxiii] relinquishing the authority customary to producing artistic work. As dancer Simone Forti wrote in her journal, "One of the engineers said, 'What we need is a lot of unskilled labor.' And there were two dancers and a composer— Cindy, Yvonne, and Cage—stripping wires. It occurred to me…that the activity, the situation, was an engineer-directed one" (1966). Although not so clearly delimitated by gender, there was a clear division of labor and of value dictated by the engineers.

The practice of programming was not yet fully defined in academic institutions or even as a legitimate scientific practice in the formative years of computing. Previously, programming was promoted as a particularly good fit for a women's career. In an article in *Cosmopolitan* by Lois Mandel, he quotes American computer scientist and United States Navy Rear Admiral Grace Hopper as stating, "Programming was "just like planning a dinner. You have to plan ahead and schedule everything so it's ready when you need it. Programming requires patience and the ability to handle detail. Women are 'naturals' at computer programming" (1967, 52). In understanding women's role in the early development of computation, STS scholar Janet Abbate conducted interviews in the United Kingdom and the United States with white American women who worked during the years between 1940 to 1980[xxxiv] in the specified areas of programming, computer science, and some managerial positions. She argued that one of the only areas of difference between men and women came down to what they thought the computer was able to contribute to society. Women placed "high value…on having their work contribute to solving real-world problems…[creating] a connection between their technical work and the needs of real

users" while men were enticed by computing to achieve technical mastery and to increase their wealth, status, and public recognition (2010, 220).

The development of technology as a field of study in the institution and as an untethered market in industry further gendered the division of labor. Harvard, Massachusetts Institute of Technology (MIT), Princeton, and Carnegie Mellon were some of the first universities to establish Computer Science programs, under the umbrella of Electrical Engineering departments. From institutional research labs and more established companies, programming was "transformed into a high-status, scientific, and masculine discipline" (Ensmenger 2010, 136). In the standard practices of any research and scientific development firms, like Bell Labs, the more male-dominated focus on innovation was encouraged to promote business. The importance on goal-oriented newness in technology could be seen as a drive in the *9 Evenings* event, and as a consequence, a division of labor occurred as well. In this era, a tension existed between the material relations around coding alongside the entanglement of gendered forms of labor versus the imaginaries of female robots. On the one hand, the material gendered relations of technology created room for productive change. On the other hand, the imaginary gendered relations of technology staunchly resisted any new progress.

The Body Politics

In Rainer's autobiography *Feelings are Facts,* she reflects back on the time period in the 1950s, stating "What is striking as I read this chapter is the paucity of women in roles other than wives, mothers, or performers and the total absence of gay culture and people of color. It was indeed a different world that was about to undergo vast changes, or at least make a great many of us painfully aware that it should" (2006, 113). In the following decades of the 1960s and 1970s, some of the most positively transformative, yet troubling years occurred for socially and politically oppressed bodies in American culture and elsewhere. The civil rights movement, antiwar protests, gay rights movement, and women's liberation movement[xxxv], to name a few, all radically fought racial discrimination and/or sexism for a more egalitarian and just society. In particular for "women, lesbians, and gay men, a much more concrete body politics was at stake in the 1960s and 1970s…who controlled actual human bodies" (Self 2013, 240). As radical feminist and poet for the antiwar movement Robin Morgan loudly proclaimed in New York's

underground magazine *Rat* in 1970, 'White men are most responsible for the destruction of human life and environment on the planet today…it seems obvious that a legitimate revolution must be led by, *made* by those whose who have been most oppressed: black, brown, and white *women* – with men relating to that the best they can.' And then the political became personal" (Gitlin 1987, 374). From first-wave feminism's fight for the vote, second-wave feminism furthered the cause to fight the legal and social restrictions imposed on female bodies and marginalized others by the private and the public sector.

Several positive outcomes coming from the women's liberation movement included the ideas and actual enactments that happened with regard to "the empowerment of ordinary women to think and speak about their own lives and bodies and to conceive of those lives in relation to structures of power" (Self 2013, 255). The authority to speak from one's own experience and contribute from this position led to real change in shifting notions of what empowerment meant for women and other marginalized groups. As Rainer reflects herself,

> I started reading the angry experiential writing in Robin Morgan's *Sisterhood Is Powerful* and the fiery polemics of Valerie Solanas…and Shulamith Firestone's *Dialectics of Sex*…their writings, and those of a welter of other feminists, gave me the impetus to begin examining my experience as a woman – that is, a person positioned in the social hierarchy of patriarchy – but also gave me permission to think of myself as an intelligible and intelligent participant in a culture and society (2006, 386).

Even if women still could not acknowledge their experiences as valid— possibly a socialized trait of women in general to not vocalize their feelings—the permission now was granted and resonated throughout all practices of life, particularly in the field of dance.

After the postwar era, a slew of strong female dancers led the development of new modern techniques infused with emotionally, gut-wrenching movements. Following the trajectories of Loie Fuller, Valentine de Saint Point, Giannina Censi, Ruth St. Denis, and Isadora Duncan, this next generation of prominent female choreographers includes Mary Wigman (1886-1973), Doris Humphrey (1895-1958), Katherine Dunham (1909-2006), and Martha Graham (1894-1991). These women advanced modernist dance by their rebellious acts against the demands of ballet in technique and in specific character roles, eschewing pointe shoes that enabled the personification of flighty, distressed, and passive female roles. With all-women dance troupes, they ran the show as managers, choreographers, and performers. They

reconnected back to their bodies and to the earth with weighted, floor-based, and bare-foot movements in abstract works.

Graham, in particularly, revolutionized and refocused the cultural epicenter of modern dance in America. Within her work, "Graham redefined the boundaries of what could be thought of as feminine in dance. Rejecting the seductive and illusory as represented, for example, by the orientalism of Denishawn or the weightlessness of ballet, she revealed the materiality of the body by accentuating effort, weight, and force" (Bannerman 2010, 33). Some of Graham's more renowned company members included Eric Hawkins, Merce Cunningham, and Paul Taylor, who all left to create their own unique techniques, choreographic works, and companies in New York City.

From the more codified modern techniques and separation from ballet, the field of dance progressed even further after a gathering of artists met at the downtown space in Greenwich Village in New York City around July 1962. Under the direction of John Cage and Merce Cunningham, a collective of dancers, composers, and visual artists (Steve Paxton, Fred Herko, David Gordon, Alex and Deborah Hay, Yvonne Rainer, Elaine Summers, William Davis, and Ruth Emerson) began creating and performing works at the Judson Memorial Church. The newly formed collective of the Judson Dance Theater emphasized diversity and freedom in dance. They wanted to refute all previous definitions of dance, the dancer, and transform how dance could be displayed. In accordance with the oppositional politics of the social movements, Judson Dance Theater was an oppositional aesthetic to the current dance canons.

The Performance of *Carriage Discreteness:* Dancers, Everyday Objects, and Technical Apparatuses

As one of the co-founders of the experimental Judson Dance Theater, Rainer created work ranging from the personal to the political in the formats of post-modern dance performances to experimental films. Born in 1934 in San Francisco, California, she later moved to New York City at twenty-two years old. After a brief introduction to acting when arriving to the city, she eventually found a calling in dance, studying with Martha Graham, Merce Cunningham, Anna Halprin, and Trisha Brown. In the late 1970s, Rainer shifted focus to filmmaking to more fully address social and political issues, particularly feminism. As she

recalls, "Writer Audre Lorde once said something like, "You can't dismantle the master's house using the master's tools." By the late 1970s, I would have rebutted, "You can, if you expose the tools" (Rainer 2006, 446). Ten years later, Rainer started to identify as a "political lesbian," entering into a world where she was able to disassociate from the "vanities and bodily obsessions" from "dance and heterosexual social imperatives" (162, 437). Her affiliation with queer activism occurred prior to identifying as queer herself in the 1990s, but during the time of *9 Evenings*, she was not queer-identified. Despite any specific sexual identity, the ideas and actions that arose out of the Judson Dance Theater methodologies, and specifically Rainer's performance work of *Carriage Discreteness*, can both be read as a queering artistic practice, destabilizing normative structures in dance and technology. She created new movement techniques to counteract destabilizing normative ideas around choreography and body images. She challenged prescribed notions of technology by changing the design and function of devices.

To understand the relationship between queer theory and art, I relate the concept of queerness to art practices and the concept of assemblage to the body and technology. As Barad eloquently defines it, "queer is itself a lively mutating organism, a desiring radical openness, an edgy protean differentiating multiplicity, an agential dis/continuity, an enfolded reiteratively materializing promiscuously inventive spatiotemporality" (2012, 29). Queer is not an identity, but a position of action to radically question fixed notions of identity and subjectivity. Queer art is "produced as a contrast against which normalcy is produced and codified," writes Jeremy M. Barker in his discussion of the 2012 Queer New York International Festival, and continues, "Hence, queer art never is, it never fully arrives. It is always, disrupting, refusing, and resisting the ever-shifting power of normativity and dominance, in an effort to carve out more material, affective, and aesthetic space for anyone who is brave enough to want it" (2012, 3). Artistic works can act to produce temporal and spatial distance from fixed boundaries of problematic binaries. Though this "deferral and a gap," a possibility of agency opens up to all participants where "various embodiments and fantasies can be experimented with that are neither restricted by norms nor do they become imprinted into the body as new norms. Connections can be created or entered into that initiate processes of self-transformation and self-fashioning" (Lorenz 2012, 20). The relations between dichotomies such as "natural and artificial, animate and inanimate…tends more to produce connections to others and other things than to represent them. What becomes visible...is not people, individuals, subjects, or identities, but rather assemblages"

(21). In queer art, the action of undoing is crucial, a way to unpack how normalized conditions exist and to reconstruct them otherwise.

The concept of "assemblages," detailed by feminist cyberspace theorist Diane Currier, makes legible the relations of power in Rainer's work. For Currier, assemblages are composed of active elements, not understood as "unified, stable, or self-identical entities or objects" (Currier 2002, 531). An assemblage depends and is constituted by the "forces and flows of components" which encounter and link up with "forces and flows of other elements" (Ibid.). In this relationship, subjects are never stable entities because "assemblages are always in motion and cannot be kept stable in any semiotic grid. This human is a being in motion, an effect of many processes…[that] cannot be the sites of fixed sexual, or gender, identities with determining functions" (Landström 2013, 393). The main emphasis is on the *affects* the *relationship* between these different elements produces, to destabilize problematic categorizations of identity and subjectivity. The concept of the assemblage addresses the multiple factors of relationality occurring within the context of the Judson Dance Theater and Rainer's performance works.

I understand the Judson Dance Theater and their collective as an assemblage. The "rigidly constructed, individual-oriented, hierarchical society" constricted people in all situations and the Judson Dance Theater were looking for other ways through "spontaneity and improvisatory methods to provide a better life" (Banes 1978, 45). To challenge the restrictive political and social systems in play through aesthetics, they redirected authority, emphasized process over product, and developed different methods of generating movements. From theory to practice, Judson's dancers opened up a queer space to try to unravel traditional power structures of gender, dance, and technology.

After the initial concert of the Judson Dance Theater, Steve Paxton and Yvonne Rainer organized weekly workshop meetings to exchange ideas and show work. Lowen writes: "The idea was to have an open and free situation without any central authority or hierarchical structure: anybody could come in, any movement could be accepted, and any material could be legitimate and used in anyway desired…Painters, sculptors, and others untrained in dance were accepted as dancers and choreographers, some with no prior performance experience, others having studied dance, in a concentrated way" (Loewen 1975, 24). Any prescribed notions of what a choreographer was and should be were eliminated, challenging prescribed identities and subjectivities. In the act of creation, the relationship between animate and inanimate objects

became the impetus for new movement. When they included technology, the artists regarded these objects "in terms of their qualitative contributions – to be worked with and around as materials with unique properties, similar to the way that they worked with wood planks, rubber balls, stairs, mattresses, texts, voice, and bodies" (Morse 2007, 4). An assemblage was created visibly on stage, an experimentation of connections between human-non-human phenomena to reconstruct gender, dance, and technology otherwise.

These ideas translated into Rainer's performance event as well. In *Carriage Discreteness*, Rainer and Per Biorn created intersecting different movement patterns between technical apparatuses, everyday objects, and performers. Rainer initiated the actions one at a time, both the technical components and the performer's tasks, through walkie-talkies and receivers. Any cross-links between these two sequences occurred randomly. The performers were a mix of both dancers and non-dancers of both genders, dressed casually: Carl Andre, Becky Arnold, Rosemarie Castoro, William Davis, Letty Lou Eisenhauer, June Ekman, Ed Iverson, Kathy Iverson, Julie Judd, Michael Kirby, Alfred Kurchin, Benjamin Lloyd, Meredith Monk, Steve Paxton, and Carol Summers. There was neither a hierarchy between nor a pre-determined role for each gender, dancer or non-dancer, or for any of the specific objects (technical and other) in the performance. In *Carriage Discreteness*, performers moved objects and their bodies in accordance with the weight and effort of those materials to designated, spatial locations. In acknowledging the effect and actions of the different materials in play (everyday objects, technical devices, performing bodies), Rainer challenged traditional notions of identity and subjects on stage.

Rainer's intention, with her use of more than a hundred objects and sixteen performers, was to destabilize norms in dance on stage and in creation. In removing the body as the star, Rainer disrupted bodily ideals of virtuosity and form. By mixing different methods from an array of practices, including Cage's chance procedures, influences from visual artists such as Robert Rauschenberg and Robert Morris, and fellow dance colleagues, Rainer was able to develop movement, departing from codified techniques, highly athletic tricks, and habitual movement patterns. Additionally, improvisational sessions with fellow dancers Simone Forti and Nancy Meehan piqued "Rainer's interest in repetition, social contact, unusual positions, and fragmented movement" (Banes 1993, 12). Her creation of movement came from improvised moments with various objects, a more task-based and object-oriented method. Movement

sequences were formed by the manipulation of objects, and reciprocally, the objects affected the performers' gestures, weight shifts, phrasing, and other components beyond their control (Banes 1978, 43). This work had no narrative arc, as the task-based movements were the purpose of the dance.

Not only did this form the method for her creative process, but also "the unadorned execution of movement tasks" acted as her "finished performance material" (Morse 2007, 5). Departing from highly choreographed stage productions, Rainer purposefully created shows in front of an audience to demystify the process of movement creation. Movements were pedestrian-like, a more accessible, democratic performance[xxxvi] that transpired from the everyday performer to the spectator. The performance was an embodiment of object-oriented dance to create connections and reciprocal transformations of both human-non-human phenomena.

She attained the goals of her infamous "NO Manifesto" from 1965, proclaiming, "NO to spectacle no to virtuosity no to transformations and magic and make-believe no to the glamour and transcendence of the star image no to the heroic no to the anti-heroic no to trash imagery no to the involvement of performer or spectator no to style no to camp no to seduction of spectator no to the wiles of the performer no to eccentricity no to moving or being moved" (1974, 51). In another form of queering, her manifesto clearly outlined her intention to disrupt, refuse, and resist normative and dominant ways of doing anything. In both forms of movement and text, these performative acts shifted normative behaviors and experiences.

With regard to technology, Rainer's decentered strategies pushed against the focus on the technological aspects of the performance over more distributed and mundane actions. In a previous work, *At My Body's House* (1964), Rainer collaborated with engineer Billy Klüver with the intention of performing with a device that could transmit her heartbeats sonically in real-time, but the technology wasn't possible at that time. Instead, she wore a wireless contact microphone designed by Klüver that amplified her breathing. The dance began in stillness, followed by "small, rapid footwork" and her voicing a story from *The Diary of William Bentley* about an eighteenth-century elephant (Rainer 1974, 295). Rainer's intention was to "reveal more of the body in the *effort* of dancing" through this technological device by expressing inward bodily phenomena outwards (Bardoit 2005, *my italics)*. In the amplification of her breath, she was able to transmit a particular kinesthetic element of her body. As the sound of her body resonated in the space, her choreographic work "emphasized the kinesthetic rather than the visual

sense, inviting spectators to respond empathetically to sensations of movement and touch" (Reynolds 1999, 297). Additionally, the work showcased her specific aesthetic of paralleling multiple mediums and actions (text, sound, movement, technology) at the same time to create sometimes absurd and other times abstracted connections.

Although she previously sought out technical innovation from Klüver for her creative works, in Rainer's correspondence about *9 Evenings* with Claire Bardoit in 2005, she says that she "wasn't interested in technology…Now, I am a techno-hysteric…really, I'm not comfortable with technology" (2005). Despite her vocal proclamations about disliking technology, it was only through this apparatus that she could achieve the effect of revealing her body's inward efforts on stage to the audience. Additionally, she had previous experience in collaborations with engineers and with the use of technology in her work. As soundwalk artist and researcher Andra McCartney states, "the discourses of technology are particularly objectifying, representing the relationship between artist and work as one of gendered power and control" (2000, 317). During the production process, gendered situations arose that negatively affected the collaborative relationship between the engineer and the artist, as well as the tension between innovation in technology and the aesthetic outcomes.

Between the engineers and artists, the extreme focus on technical innovation[xxxvii] heavily strained the collaborative spirit and ultimate aesthetic outcome. With the development of computer technologies that could replace jobs and the capitalist insistence on newness and productivity, Bell Labs still had an impetus to produce. In this event, they were not interested in creating patents and did feel their collaborations with artists were more 'play' than 'work,' but they were also aware of the possibilities of new discoveries that could lead to "new industrial applications – and hence new market sectors – for the company" (Kuo 2013, 274). The combination of the drive for innovation alongside the divide of labor roles between engineer and artist altered collaboration process. In Rainer's 2006 memoir, she reflects on her experience of the event, stating "…it became apparent that the technicalities of the venture were overwhelming for everyone…I was assembling hundreds of objects that were to be moved either electronically or by my performers, ranging from a single sheet of typing paper to six mattresses and two fifty-pound Otis elevator weights" (2006, 275). In contrast to dance, where the star of the concert dance is usually the prima ballerina in ballet or the choreographer in modern dance, the star of the show in *9 Evenings* was technology.

Another challenge, as Bardiot states, was the inability of engineer and artist to find a common language to discuss the technology and the artistic intentions: "Artists frequently had the impression that the engineers had assumed too much control over the artwork and that their preoccupation with technical matters threatened to constrain the aesthetic impact of the performances. For their part, engineers found that the artists did not have a realistic understanding of the technical complexities of their ideas" (2006, 46). Rainer's inability to possibly understand how technology traditionally worked presented the opportunity to alter the prescribed function of the device. Biorn spent a significant amount of time figuring out how to shift a synchronous motor's function of rotation so as to control the directionality of an object (make it go up and down). Biorn and Rainer jokingly labeled this machine a space spider (Figure 18), a reference to the Space race combined with the actions of a spider. The development of the space spider was an affordable device that altered the traditional functionality of the device.

In collaborations between dance and technology, an array of complications can arise that debilitate the artistic outcome. First, the amount of time in the rehearsal process can become uneven, focusing on the development of technology to the detriment of movement creation. This can present a problem when there is no dialogue and collaboration occurring between technologist and choreographer during rehearsals. The process of conducting "open heart surgery on the motors," as Biorn described, took "a huge proportion of time…kept me busy" (2004). Rainer identified herself as "Biorn's errand girl, going back and forth to Lafayette Street to buy motors, transistors, circuit boards, and other paraphernalia required for the programming of the remote controlled 'events' in my piece" (2006, 275). But even in the process of her work, roles became muddled. Rainer might have identified herself as an 'errand girl', in keeping with how women perceived their role with technology more generally, but she also put significant pressure on Biorn to uphold her artistic intention regardless of technical finesse.

For example, although Rainer now emphasizes her hostile attitude toward technology during this time, some of her ideas around what to devise were quite profound. After the showing of her films in *Carriage Discreteness*, she wanted the screens to topple down, removing the stability and the prescribed functionality of the device altogether. As the engineer Biorn observed, "The idea that you would build something that would fall apart . . . in a programmed way . . . turned my whole idea of engineering upside down" (Bonin 2004). In the world of engineering, the notion to disrupt or destroy does not correlate to their practice and idealization

to fix. Additionally, in an increasingly capitalistic system, the ideal is to create and repeat profitable products, not the other way around. In art, the structures of performance allow an opportunity to express and to challenge ideas, relatively, in an open, imaginative and experimental space of the theater. The ephemerality of performing challenges forms of representation and repetition (Phelan 1993) by offering resistance to production and innovation.

Within the performance event, more problematic divisions of labor dissipated as an unexpected juxtaposition of power occurred during the first showing. As dance scholar Sally Banes argues, the "dance stage has often reflected and reinforced, but has also formed and in some cases criticized cultural conceptions of corporeality – in particular, conceptions of women's bodies and identities – and that through dance, men's attitudes toward woman and woman's attitudes about themselves are literally given body on stage" (1998, 1). In *Carriage Discreteness*, Rainer removed her body from the stage altogether, placing herself on the balcony to give directions through walkie-talkies to her fifteen performers (Figure 19). The technology enabled this departure. The device generated her presence onstage through her voice, but removed the visibility of her actual body.

Although Rainer undertook a directorial position, an uncommon role in the majority of her work, the technology restructured this act. As she remembers, "The walkie-talkies didn't function. Nothing seemed to be happening…Rauschenberg suddenly appeared on his hands and knees at my feet to tell me that the electronic events weren't working. Finally all I could do was instruct the performers to move the objects at random" (2006, 275). The failure of technology combined with her removal from the stage all created a particularly temporal and spatial distance from the act of objectification.

Although Rainer sees herself at the time in a controlling authoritative position, her removal[xxxviii] from the stage suggests something different. As she recalls,

> On the evening of the performance I sat with my walkie-talkie in the remote balcony overlooking the 200x200 performing area like a sultan surveying his troops on a vast marching field. (The choice of this imperial position has been a source of much subsequent embarrassment for me). Why couldn't I have allowed the performers to move the objects in any way they pleased? After all, the piece was about 'the idea of effort and finding precise ways in which effort can be made evident or not" But no, I had to exercise my controlling directorial hand (2006, 275).

Rainer was clearly appalled not only by the military historical implications and contexts in which this technology is used, but also by the specific situation of female artists under the power of the

male gaze. In hindsight, this provided Rainer with a strategy to both evade objectification of her female body and to give space to other resonating agencies. Previously, in her most renowned work *Trio A* (1966), she choreographed movements in which the performer never acknowledged the spectator's gaze. Afterwards, she would continue working with this strategy in her film works, where she states, "I later brought this to a cinematic extreme – under the influence of feminist film theory – in my 1985 film, *The Man Who Envied Women*, via the strategy of eliminating the physical presence of my female protagonist, thus removing her from a sexualizing gaze, both on and in front of the screen" (2006, 243). Acknowledging the extremity of removing the female body altogether at this moment in time, this strategy operated as a productive counter-attack against the norms of objectifying female bodies on and off stage and screen.

Additionally, the failure of the other technical elements focused attention on Biorn's position, where not only did the proscenium stage and intensity of the moment destabilize him, but caused quite a visceral reaction in his own body as well. In a 2004 interview, he recalls the first performance after working tirelessly through the night with Rainer. He was situated in the control booth to manage all the technical elements in her work. All the functions were wired into the TEEM system, mirrored off of the ENIAC machine, but the wiring was configured backwards. While attempting to run the different technical events, he comments, "my stomach just literally dropped to the floor" (2004). Under the stage lights, he had to understand the problem and come up with a solution extremely fast which led him to control the show by jamming the stepper-switch with a screwdriver when hearing Rainer's direction. This experience really shook him up. He recalls,

> I dislike being on stage and in that sense, *9 Evenings* was a nightmare, I really don't like to be in the lime light, but the artists, I know, performing artists, that is where they want to be…we didn't want to be there if things go wrong… engineers don't accept that bridges fell apart… get the heck out of the way, we aren't performing… apart from that, there was a lot of technology I never worked with before… kept these things in mind later on for design (2004).

The artistic process certainly aided in the engineer's ability to work with different technological devices, forcing him to dismantle the prescribed functions to create a new apparatus altogether. But the technologies also affected both Rainer and Biorn in different ways. The technical failure that occurred in the process, and even worse, on stage during the performance, reconfigured

problematic binaries of power between 'human and the machine', 'male and female', and 'subject and object'. The TEEM machine and all other mechanical operations, were housed in a designated control booth, hidden from the audience in a central location in the Armory. To promote the spectacle nature of technology, the engineers placed the TEEM specifically to render the inputs of the machine invisible so only the outputs were visible onstage. A jarring moment happened in Rainer's performance that revealed the hidden components of technology. The programming of the events was organized backwards and Biorn had to react in the moment, a shift in how engineers usually operate —designing the tools and either having the artists operate the machines or letting them run automatically. Biorn had to improvise to keep the machine running, causing alarm and awareness, and, whether uncomfortable or not, connecting him back to his body.

The technology revealed its fallacy, where Biorn was the switchboard operator caught in the failure of the machine. Biorn had to adapt Rainer's queering of dance in the act of performance by the use of improvisation and kinesthetic knowledge. The failures of technology alongside Rainer's strategies with changing the functionality and design of the devices all created an opening up of space that deflected agency away from the typical auteur position of engineer or choreographer and toward a more material and discursive performance. The relationship of the various components of bodies, everyday objects, and technical objects allowed different behaviors and experiences to arise separate from the conventional components of narrative ballet and modern dance. Rainer was successful in queering dance and technology through strategies of improvising task-based movements in dance and of reconfiguring the functionality and design of technology. Although problems arose in the creative process, the constant tension altered behaviors and roles for a more productive performance. Within the performances of her work, an "assemblage" was created that avoided gender essentialism and technological fetishism. The disruption continued even against the spatial confines of the Armory Space.

Challenging Audience Reception in the Armory Space

In the reception of *Carriage Discreteness*, critics and the audience were quite harsh, partly due to the preconceived expectations of a mega spectacle fostered by the exchange of art

and technology and by the large, imposing scale of the Armory space. In one such common critique, critic David Bourdon stated, "I'd expected magic…For the technical things to be astonishing… [the audience was] ready, able and willing for a lot more than they were given" (1966). In Steve Paxton's *Physical Things*, John Cage's *Variations VII*, and Robert Rauschenberg's *Open Score*, for example, audience members were invited to participate by becoming interactively involved or by moving through the works in close proximity to the technological inventions. In another comment about audience expectations, Deborah Hay stated that the audience was judging the event as the debut of "Art and Technology" and "were approaching it with a certain amount of – to use her expression – "greed." They seemed to be saying, "OK, show me what you got!" It was as if the performances had already entered the circuit of consumption, were like a trade show or (as many people described them) a circus" (Dyson 2006, 12). This sentiment seeped through all of the performance works even if not intended. In another attempt at disrupting capitalist aims, Rainer confronted the normative behaviors of the audience.

In one pivotal moment during *Carriage Discreteness*, the audience became increasingly restless and rowdy by the multiple failures and mediocre use of technology. In this moment, Rainer decided to take action and directed Michael Kirby to walk toward the audience to deliberately confront the hasty crowd, which, in turn destabilized their power to objectify. Kirby, reflecting on his experience stated,

> Soon, it seemed that all 1500 people in the audience were venting their anger at us. I had the impulse to turn my back, but that seemed like a cowardly thing to do. I folded my arms and stared at the clamorous packed stands, at least trying to indicate that I believed in Yvonne and what she was trying to do. They were exceedingly uncomfortable moments for all of us. At last the noise subsided, but one could not help but feel that simplistic notions of 'audience participation' were being promulgated far too widely (Kirby 1968, 152).

The audience's expectations were not met with the technology or with the performances shown. Rainer stayed true to her agenda, confronting the problem by her simple directive to Kirby. His walk, with no other material in hand or technical device moving, was the purest move to challenge the debilitating structures of space, audience, and technology in play.

From the beginning of their practice, the Judson Dance Theater was no stranger to working in unconventional settings, away from the traditional, proscenium stage of concert dance. In these contexts, artists were able to play with distances between audience and

performers, focusing on the small nuances of movements that occur in the body intimately or those more exaggerated movements that are completely visible to the audience, whether from sitting formations around the stage or woven (placed) into the performance space. The spatial distance between the audience and actions on stage in the Armory space, however, erased such intimate moments and details of the performer's body. In the case of *Carriage Discreteness*, the movement still revealed effort, and Rainer still followed her proclamations from the "NO Manifesto". As such, the work still successfully upheld her intentions and prodded the audience to think further on their own position and place in this event.

In commenting about the spatial structure, Rainer sarcastically remarks, "the hand of God changed the hugely dispersed configuration into a slightly different configuration" (1974, 83). In this work, "[in] the arrangement of performers in a space in relation to the audience's registration of its reconfigurations over time, we can hear in Rainer's comment an awareness, dryly humorous, of the fantasy of control – 'the hand of God' – that was linked to the audience's inability to fully perceive how the production was controlled" (Morse 2007, 15). Klüver decided that no explanation of the technology would be given, although most devices operated wirelessly and therefore the operations of the mechanisms were invisible to the larger audience. Biorn disagreed with hiding this information, stating, "I felt, at that time, if we had explained a little of it, that we might have ---that the criticism would have been a little less – instead of disharmony at the armory and those kind of things ---there would have been an appreciation that we were trying to use technology together with art to create things you couldn't do… we might want them to appreciate the technology of what they are seeing" (2004). In *Carriage Discreteness*, the visibility of the dancers' bodies, technical objects, and everyday objects was not as important as revealing the processes of "chance, disruption, and disarray [that] provided a piquant counterpoint to the predominant theme of control" (Garwood 2007, 40). Rainer was successful in causing such a reaction amongst the audience, diminishing issues of control that permeated the whole of the performance event.

The history and scale of the Armory Space echoed the problematic themes prominent within the *9 Evenings* event: the dominance of technology, the lack of visibility and intimacy, and control. Given the Armory's enormous size (some 150 feet long x 120 wide with a 160 foot ceiling) and acoustic properties (like long reverberation times), it makes sense that many of the artists in *9 Evenings* were interested in the use of wireless, remote control devices. As engineer

Herbert Schnieder recalls, "Echo and reverberation times were as long as 5.5 seconds. Working on this large scale, many artists became interested in the use of remote control for various props and effects (Schnieder, as quoted in Kuo 2013, 272). In both Hay and Rainer's performances, the artists utilized remote controlled technologies as a strategy of reaction against the dominating power of the Armory space.

In addition to the problematic sonic conditions and large-scale area, the Armory embodied power in the art world and in the military. The Armory exhibited one of the largest modern art exhibits to come to America in 1913 and served as headquarters for infantry regiments of the United States Army: "the site was charged with a twofold impetus for art *cognoscenti* and the general public, although some 9 Evenings' protagonists sought to make a strong point by using warfare technologies for artistic *cum* pacific aspirations" (Lacerte 2005, 2). In an era of advancing military technologies propagated from World War II to the Vietnam War, the Armory was an unlikely space for the Judson Dance Theater artists in their strategies to disrupt traditional concepts of art and politics for newly configured ways of working and showing. Yet, with the embedded histories instilled within the Armory, the artists and engineers still conjured up productive ways to collaborate and showcase a new frontier of artistic work. The strong reactions against these works reveals their success in challenging the dominant structure of space in its connection to high art and to military contexts. In particular, all three female artists of *9 Evenings* worked to destabilize elements of power reinstated by the large-scale architectural gaze through their attention to agency and materiality.

The two other female artists of *9 Evenings*: Deborah Hay and Lucinda Childs

Given the fact that there were two other female artists involved in *9 Evenings*, how does their work compare or support the same type of strategies Rainer employed in her artistic work? As Meredith Morse states, "Although Rainer and Hay would consider 'energy' rather differently in their later work, we can see a common interest at this time, as in Childs' 'Vehicle', in the energy commensurate to a particular activity, and the movement of energy between forms and processes" (2007, 9). In the development of their work, all three female participants opened up the possibilities of agency by focusing on the affective and material potential of technology through bodily movement.

Hay's *Solo,* for example, consisted of twenty-four performers (sixteen moving performers and eight remaining stationary) and eight remote-controlled moving platforms. Both moving performers and controlled platforms enacted movement through a walking motif, attributing "equal time and visual prominence to all the elements of the performance" (Bonin 2006). The program notes indicate that Hay had an "interest in creating a middle ground between seeing and not seeing" (1966). The performers could position themselves in any form on the platforms or not, as both elements could be either passive or active. The work was divided into three moments, with the musical composer directing all the "stationary" engineers on stage that controlled the remote-controlled platforms (Figure 20).

Art critic and feminist writer Lucy Lippard was quite critical of Hay's work. "The statement is to some extent wishful thinking. The light was never so white, the evenness never so striking, but then, Miss Hay was another victim of technological failure…only three of eight of her remote control platforms, were working correctly….Deborah Hay was the most active performer (too active in contrast to the others); the rest varied as to quality. Something didn't work out" (2006, 72). Although all of the platforms were not working adequately, this apparatus was not the only object on stage in action.

I disagree with Lippard's overall critique of her work. Instead, it seems that Hay was playing with destabilizing the power of vision in multiple ways. Vision has been categorized as the most "cerebral of the senses" upholding the Cartesian division of mind over body. Feminist scholars have highly criticized the sense of vision due to its powerful association with the mind and "distanciation from the body," as well as its power to objectify and control the seen object (Marks 2000, 133). What is important to note in dancing, so often labeled a visual medium, is that the different components of the body in movement contain and emit more knowledge than what is visible. Dance can disrupt the hierarchy of vision over the other senses.

For example, in *Solo*, the performers were dressed all in white, positioned on or around the remote-controlled white platforms. On the side, all of the platform operators were in a row across the length of the stage. Hay's intentions were to attribute "equal time and visual prominence to all the elements of the performance, from the dancers and props to the lighting and soundtrack" (Bonin 2006). The moving bodies embodied the moving robotic platforms, alongside other sensual elements of lights, sounds, and space that created a particular affective experience for the audience. The crucial element of the bodies and technological devices moving

in contrast to the stationary element of the orchestration of engineers was a provocative statement about objectification. The performance raised awareness about the power of who is able to see and what is being seen. Although the performance might not have gone as planned, the strategy was useful in its attempt to disrupt the power of the gaze, to reveal all human-non-human phenomena as agential participants, and to demystify the spectacular, magical component of technology.

Through different strategies to open up possibilities of agency and to disrupt power structures, Lucinda Childs's *Vehicle* was divided into three movements to explore parallel situations that played with the qualities and limitations of each stage element (technological tools, performers, space, light, and sound). Her work consisted of three dancers (William Davis, Alex Hay, and herself) weaving in and out of the various technological objects and spaces. Two main technological tools were invented specifically for this work: the Ground Effect Machine and the Motion Music Machine. The performer Alex Hay entered into the Ground Effect Machine, a slightly raised cubicle driven by two vacuum cleaner motors (Figure 21). The motors slightly lifted the cubicle from the floor, where anyone standing inside could move the device, depending on their weight, from side to side. The engineer Manfred Schroeder invented the other technical device, the Motion Music Machine. Schroeder stated, "Dancer Lucinda Childs was asking for things to translate body movements directly into sound, so that she could actually create her own accompaniment as she danced. We came up with a device that reflected ultrasonic waves from her body, then converted them to audible sound" (1967). The real-time creation of the sound was projected by way of a visualized waveform on a screen behind Childs and transmitted through twelve speakers surrounding the space of the Armory.

In *Vehicle*, Childs generated an atmosphere more akin to recent works with digital technologies by creating apparatuses that enable performers to influence other outputs in real-time. Her focus in translating bodily gestures into sounds is one of the foregrounding motives behind much of the recent developments in motion capture technology to sensor-based devices. Through the Motion Music Machine, the movement of her "arms, torso and assorted objects (plexiglass cube and three buckets) suspended from a metal structure was intercepted by the beam, and sound waves were emitted that varied according to the different angles and speeds" (1967). In an intra-active relation, Childs's movements changed the materiality of sound while the feedback received from the sonic outputs changed her movement patterns.

In discussing the relationship between bodies and interactive technologies, Johannes Birringer views "artistic practices that respond to technical interaction" as creating "an entirely new poetics [that] emerges when performers 'navigate' interactive environments, dive into data-based information…when the body becomes an instrument of a dynamic environment in which realities are generated and processed" (2008, xxiii). In this type of practice, the emphasis is no longer focused on the body as object, but on the reciprocal process between the "shifting relational architecture that influences her and that she shapes or that in turn shapes her" and the environment (112). As is evidenced by the engineer's discussions, Childs was active in not only navigating this new environment using her body and the buckets to create the sonic soundscape, but also in creating the initial idea behind the development of the technological devices. In turn, she herself was motivated by the system she created, through how her body and the buckets moved.

In the case of *Vehicle*, subjectivity or even the notion of a gendered body was rendered inconsequential to the reciprocal interactions that occurred between the performing bodies, objects, and technological devices. In earlier works of Childs, she "devised her own method of evolving movement material by manipulating objects" with a sense of energy created by everyday experience (Banes 1979, 134). The motifs around energy, effort and the use of objects, bodies, and technology follow this trajectory in creating a complex web of entangled agents ricocheting off each other to create the performance event.

Furthermore, in solidarity with both Rainer and Hay, Childs's work also raised concerns around issues of visibility: What are technology and the body doing? What are their purposes, and how are they displayed to the audience? Curator Catherine Morris, who was responsible for a large scale retrospective of *9 Evenings* in 2006, comments that Lucinda Childs's "technological experiment succeeded in making the animate nature of electrical frequencies visible to the human eye, transforming them into a vehicle for dance-like movements" (2006, 11). Yet, not all critics were completely convinced of the relationship established by Childs between bodily movement and the resulting transduction into visualized patterns. Lucy Lippard argued that "there were all kinds of fascinating effects in operation, but the visual result was not as clear. Ironically, the concept was blurred by technology and technology by action. Yet this is one work which attempted to utilize electronic devices in an entirely new way…it did move into an area of pure scientism with the daring expected of an art" (2006, 72). The actual critique of Childs's

work solidifies her success in disrupting the power of vision, blurred by the action of technology and the body, working in movement together.

Furthermore, Childs's *Vehicle* predates many of the ongoing investigations of visibility in interactions with technology, asking whether audiences have a desire to understand the importance of real-time manipulation or not, and whether this changes the intention, the narrative or content, and the aesthetic components of the work. In interactive systems, the question of whether there is a need to make systems transparent (visible) or receptive (understandable) to an audience which otherwise might be "invisible (the mapping from input to various forms of output)" is debated (Birringer 2008, 146). As seen through the commentary from Morris and Lippard, two different perspectives emerged on how technology did or did not make visible the effects that it was producing. In Childs's work, the movements of her body and that of the buckets created actual sound waves and projections, signifying that such technological processes can be made visible by viewable images, but how close the connection between the sound being processed to the waveform image is unclear.

The coupling of sound and gesture has quite an extensive history in the field of music and was not particularly new. Yet, the difference was in considering the whole body within a responsive environment. The need to adapt to a dancing body shifted the technical design and predated recent technology used in the creation of digital dance performances. The impetus to destabilize the power of vision was a strategy of the time to disrupt objectification of the female body, which had been overtly sexualized in dance. But it also provided an opening to consider the other elements in action, to account for their agency and affective components to their bodies, to the audience, within a specific time and space.

Conclusion

The event of *9 Evenings* still haunts the dance and technology spectrum to the present day, specifically as it challenged stereotypical gender roles and the development and use of technology. *Carriage Discreteness* historically roots my investigation within the early development of computational devices in the era of the Space Race. Within this decade of seemingly limitless technology, where disciplinary vigor and codification of techniques were not yet defined, the era was ripe for transformations. The materiality of computer code was based on

a binary system, but did not rely on any particular gender to function. Women's work included the job of programmers. Furthermore, the focus to the body in politics spurred by the social movements of the 1960s presented opportunities for marginalized others to speak up and to challenge traditional conventions in array of different systems. The climate of ambivalence and disarray opened space for the Judson Dance Theater's female artists to interrupt the disciplining of the female body machine.

Rainer, Hay, and Childs all created works that were "examples of feminist dance actions, of body art which escapes phallocracy" (Export 1989, ed. Robinson 2014, 352). In revealing the process and effort of all agents in the performative act, all three female choreographers demystified the spectacle by shaking up the dominant modes of technology, dance, and gender, influenced by John Cage's teachings of chance operations and by Judson Dance Theater's interest in the *everyday* and task-based movements. In questioning what is feminist about technology in performance art practices in the *9 Evenings* event, all three female choreographers investigated questions of authorship and intentionality on the part of the choreographer, performer, objects, technical apparatuses, and spatial configurations. Particularly in Rainer's work, the process and performance queers structures of gender, technology, and dance, providing a more hopeful and egalitarian way of making and presenting performance art.

Yet, in the process, prescribed gender roles persisted in labor roles. Artists performed menial technical tasks as cheap workers, and, in turn, lost control of their formidable auteur role of choreographer. In collaborations between the engineers and female choreographers in particular, issues and tensions arose that further disturbed the creative process and focused too much attention on the creation and execution of the technical devices.

Despite these downfalls and particularly within the aspects of dance, gender, and technology, however, Rainer made important strides toward destabilizing power structures, even within a male-dominated event such as *9 Evenings*. With technology, Rainer took Biorn out of his comfort zone by redirecting engineering —asking him to destroy technical objects rather than produce something new. In dance, Rainer took the process into the performance event with her improvisational directives, everyday movements, and task-based choreography.

Within the performance event, technical devices were elements in an assemblage that only operated by the forces and actions of other elements (performers, Biorn, Rainer, and the everyday objects). The equal weight she places on all entities enables their agency to change the

whole of the performance experience. The action does not rely on one object alone, but the continual process of all entities to shape and change the spatial and relational configurations.

Rainer thus created a dynamic entwinement of agency, where through the action of these specific objects (human and nonhuman) the "ongoing reconfiguring of both the real and the possible" (Barad 207, 177) is generated. Rainer broke down the hierarchical power structures involved in the relationships between technological apparatuses, everyday objects, and human bodies, mirroring that of agential realism. Her performance was a successful intervention, shown by the hostility of the audience, in queering structures of dance, gender, and technology within the space of the Armory.

Chapter 3: *Loopdiving Control*: Into the Digital Frontier with Troika Ranch

loopdiver

The journey begins with a simple idea of "loops"--- investigating computer-programmed processes of repetitive loops-- physically and emotionally. The performance begins with electronic, echoing, high-pitched pulsating clicking noises layered with female French performer Johanna Levy's vocal fragments of her experience under the confines of the loop. The configuration is a traverse stage where the audience is located on both sides of the stage in close proximity and at the same level as the performers. The mise-en-scène includes three rotating steel-framed platforms with two screens each in the middle of the stage, with the approximate dimensions of the screens measuring eight-feet tall and four-feet wide. There are three chairs set up at both sides of the stage in front of the audience. Slowly, each performer enters and walks around the stage. Walking, walking, back tracking, standing, looking around. Repeat. At times, performers glance at each other when in close proximity, embracing gently by a hand on a shoulder only to retract again. At other times, they walk in solitude with their gaze focusing inward. Eventually, while walking and connecting in brief moments with each other, more movements of rubbing elbows, shoulders, and other body parts add on to their repetitive phrases, concluding in this section by arriving to the chairs (Figure 22). *The lights darken and shift to highlight the area of the performers siting down in unison.*

An electronic beat initiates the visuals to react and the performers to reboot to an upright sitting position. Within these rhythmic electronic clicks of high-pitched noises that escalate in speed and stretch across the space in volume, the performers oscillate between slouching and more upright postures, occasionally rising up to look at the audience and lowering back down. The section climaxes in sound where the performers pause facing the audience. A violent crash as the dancers fall to the floor and the noise amplifies into the red zone. Blackout.

The performance continues…

The Trajectory of *loopdiver*

In 2009 at the Lied Center for Performing Arts in Lincoln, Nebraska, dancer and choreographer, Dawn Stoppiello, and musician and computer programmer, Mark Coniglio, of the dance/theater/media company Troika Ranch premiered their work *loopdiver*. The work revolves around a single process: to explore the concept of loops. The premise for the work started by video recording a six-minute choreographed dance. A specifically designed loop modular in Coniglio's *Isadora* software manipulated the video footage to create a sixty-minute choreographic score.

Loopdiver is described in their 2007 promotional material (Figure 23) as an "evening-length multimedia work for six performers and interactive media built completely from interwoven loops of movement, text, music, and interactive visuals. These loops stand as a metaphor for all of life's repetitions: while repeated experiences may be comforting in their predictability, they also offer the potential for a dangerous and numbing prison of the expected" (Coniglio and Stoppiello 2007). They traveled and performed the work at The Dance Center at Columbia College, Chicago, IL in 2010, the Ufer Studios, Berlin, Germany in 2012, and at the Platforma Festival, Moscow, Russia in 2013.

In addition to the co-direction of Coniglio (videographer and composer) and Stoppiello (choreographer and performer), the work is a collaboration between dramaturge Peter C von Salis, lighting designer David Tirosh, set designer Colin Kilian, production manager Jennifer Sherburn, and performers Morgan Cloud, Jennifer Kovacevich, Johanna Levy, Travis Steele Sisk, and Lucia Tong. The final performance combined the performers' video recorded looped movements through algorithmic processes, their translation of the video material into physical movements, and additional digital materials of lights and sound looped to "absolute precision and perfection" by the computer (Coniglio and Stoppiello 2016). There were no interactive real-time digital components, only composed and pre-recorded loops of text, movement, sound, video, and lights. Troika Ranch (TR) asked the audience "to join in on this simultaneously dreamlike and maddening journey as the performers attempt to escape their prisons of repetition. The meaning of the materials grows and changes as it appears again and again, ultimately challenging us to dive in and break free of our own repetitive and potentially destructive behavior" (Ibid.). *Loopdiver* follows approximately twenty years of TR investigating the

development and use of technology while interacting with the body in the creative process and through performance works.

Into the Digital Frontier

After growing up in the American West, Stoppiello (BFA dance) and Coniglio (BFA music composition) attended college at California Institute of the Arts. They met in college in 1987 through Cristyne Lawson's composition class, where they were randomly paired together as dancer and musician to work as collaborators (Interview with Horwitz 2014). After continuing to work together for some time in the Los Angeles, California, they eventually moved to New York City in 1994, married, and formed their dance/theater/media company Troika Ranch. Their repertoire ranges from site-specific dance (*Raids* 1996-1998), web animation (*Yearbody* 1996), telecommunications in theatrical dance (*Tactile Diaries* 1990, *An Adjacent Disclosure* 1991, *Electronic Disturbance* 1996), MidiDancer with real-time video feedback in theatrical dance (*In Plane* 1994, *Vera's Body* 1999, *The Chemical Wedding of Christian Rosenkruetz* 2000, *Future of Memory* 2003), real-time video feedback systems and movement (*Surfacing* 2004, *16[R]evolutions* 2006), and a dance film (*BKLYN* 2007). Recently, Stoppiello received her Master of Fine Arts in Dance from George Washington University, Washington, D.C. She is based in Portland, Oregon where she continues to perform in dance work and to teach Master Classes in contemporary dance technique, composition, improvisation and integrating media in performance. Coniglio is now most widely known as the creator behind the interactive video software *Isadora,* nestled in his company TroikaTronix. He is based in Berlin, Germany and continues to work on various projects in media art and performance. Currently, Troika Ranch is creating a new work entitled *Swarm*, an interactive performative installation.

During the period of TR's formation and work, a shift occurred from the early computational era to digital technology, changing the dynamics between technologies, power, and gendered bodies in a twofold manner. A utopic celebration of technology took place due to the advancement of computational machines. Technological advances were radically altering "human thought, memory, and understanding" where an optimistic and hopeful focus was given to "how evocative computers fostered new reflections about the self" (Turkle 2011, x). There was the introduction of the IBM personal computer in 1981, the compact disc in 1982, VHS

tapes, VCRs, and Hi-8 camcorders in the early 1980s, and eventually mobile phones in 1983. As cyberfeminist Faith Wilding proclaimed, the Net gave the impression of a "free space where gender does not matter – you can be anything you want to be regardless of your *real* age, sex, race, or economic position" (2015, 264). But this was not the case. As sociologist Judy Wajcman emphasizes, "a technological system is never merely technical: its real-world functioning has technical, economic, organizational, political, and even cultural elements" (2004, 35). As technology became more ubiquitous in society, the utopic enthusiasm drifted away and a climate riddled with fear and anxiety found comfort back in convention and stability.

Arising out of the aftermath of the Cold War, an increase of government surveillance, power and control, and loss of individual rights provoked a dystopian fear. All of these elements both reinforced existing and created new binary modes (man vs. machine, code vs. flesh, aliveness vs. dead, virtual vs. real body, designer vs. user, technophobe vs. technophile). Reinstating archetypes from the electrical era, the cultural climate promoted normative conceptions of body images and types of partnering dance. Popular exercise and dance techniques shifted focus to develop aerobic movements for a more physical, fit body and to create social routines, like disco, for maintaining traditional gender roles "in which the male led and directed the female" (Cohen Bull 2001, 411). The trajectory of contact improvisation and post-modern dance from the 1970s became more codified as specific techniques involved "highly skilled" dancers in which they "tended to move with greater control over the movement flow and a greater degree of outward focus" (Ibid.). This shift to more control, as Sally Banes has suggested, "constitutes the central attitude toward the body in the eighties" (1986, 12-13). Particularly in New York, the downtown scene still existed in attempting to disrupt the practice of dance, but the uptown scene of modern dance dominated the realms of academic and professionally training, emphasizing codified techniques and dances of past choreographers.

Furthermore, the fear of the encroachment of technology on and in real human bodies was becoming a reality. Cyborg manifestations were present with real biological entities like Dolly, the first mammal sheep to be cloned, but also appeared in science fiction and other cultural imaginings (Figure 24). Twenty-years prior, scientists Manfred E. Clynes and Nathan S. Kline coined and defined the term cyborg in 1960, to address the need for a "self-regulating man-machine system" to assist in new environments, in this case, for space travel (1960, 27). Their concept described a human-machine entity where man was able to escape the possibility of

becoming a "slave to the machine," by developing integrative technologies inspired by nonhuman organisms to assist with his bodily functions, leaving him "free to explore, to create, to think, and to feel" (Ibid.). In an era of increased anxieties around new technologies, the human (male) body created the figure of cyborg to control and stabilize the mediated environment. More recent examples combining utopic visions and alliances with machines to become cyborgs include male artists like Stelarc, Arthur Elsenaar, Catalan artist Marcel·lí Antúnez Roca, and the performance art group Survival Research Laboratories (SRL).

Contrary to the more masculine, fixed visual images and literal manifestations, Donna Haraway's metaphorical interpretations of the cyborg were intended to politically resist how the sciences, particularly biology and technology, were changing the social fabric of our lives. Her cyborg is "a cybernetic organism, a hybrid of machine and organism, a creature of social reality as well as a creature of fiction" (Haraway 1991, 149). The cyborg metaphor provided a different way of analyzing relations of human-non-human phenomena beyond fixed dichotomies and identities. To depart from utopic or paranoid understandings of a technoscience society, Haraway wants to acknowledge both rigorous, critical feminist accounts and hopeful, imaginative engagements with what has been considered 'given' or 'natural' in any field. Her position broadens definitions of technology and of gender to open up epistemological and ontological frameworks to account for contributions otherwise restricted by socio-technical and political normative structures and to highlight a cyborgian body's materiality and imagination in particular kind of acts.

Within this context, Troika Ranch's *loopdiver* and earlier works provide an entryway into discussing the complexities that arise in collaborative projects in dance-tech, as a site for assessing the oppressive and liberatory dynamics of cyborgs in reality and in fiction. To understand the multiple dynamics at play in Troika Ranch's artistic work, I unpack the particular cultural and socio-technical climate, an era that emphasized control over the rapid advancement of digital, personalized computational devices to the detriment of questions of subjectivity. In TR's research and development phase, complications arose from the design and use of technology, labor roles, and visibility of technology and of the dancing body. The performance *loopdiver* and later work of TR challenge typical structures of gender, dance, and technology by highlighting an emotive and female-centered experience of a cyborgian body, possibly influenced by the autobiographical accounts of Stoppiello. After this work, Troika Ranch

changed their process of working and, consequently, focus of their materials, thematic content, and ways of working transformed. Stoppiello's *Salon du Garage* series (2013-present), Coniglio's company TroikaTronix, and Troika Ranch's work *Swarm* (2015) all use different methodologies and aesthetics with movement and technology.

Conservative Nostalgia: The Gendered Body in the Digital Divide

With the increased use of digital technologies in the 1990s, debates raged in the realms of technology, biology, science, and arts on what computational processes were contributing to the social fabric of life. A resurgence of repetitious dominant structures of patriarchy and control, that reinstated binary divisions between male/female, mind/body, real/virtual, man/machine, permeated the culture, although highly criticized. One consequence was the perpetuation of stereotypical gender roles that led to a culture of exclusivity (white, male geeky computer programmers collaborating with female dancers and choreographers), a continuation of the division revealed by the iconic *9 Evenings* event. As Stoppiello recalls, "when I started in [this field], it was like dudes at computers, chicks in unitards" and even women in computational sectors, "we all looked like fembots. We all had these fabulous outfits on with boots and hair and cyborg-y looks" (personal communication 2015). In order to remap gendered divisions within technologically augmented dance, I briefly examine the larger context of gender imbalances, behaviors, and engagement with digital technologies.

In the cultural imagination, the persistently stubborn trope of the female machine revealed itself again, much akin to her predecessor in the electrical era. From the novel *L'Eve Future* to the film *Blade Runner*, as feminist film theorist Mary Ann Doane argues, "If Hadaly is the first embodiment of the cinematic woman – a machine that synchronizes the image and sound of a 'real' woman, Rachael is in a sense her double in the contemporary cinema, the ideal woman who flies off with Deckard at the end of the film" (119). Set in dystopian Los Angeles in 2019, *Blade Runner* cautions about the future of technology in a story depicting man-made artificially developed androids (called replicants) that escape illegally to Earth from dangerous working conditions in an off-world colony. Blade Runners are cops on Earth that specialize in terminating their existence.

The story revolves around the male protagonist, blade runner Deckard, who is meant to kill all replicants. Rachael is somewhat unaware of her situation as a replicant, as she is first and foremost a woman. In this surreal landscape, "artificial females morph into human-like creatures and struggle to stay animated and alive" (Wosk 2015, 119). Although Deckard is meant to kill Rachael, he is seduced by her beauty and compliant, sexual nature. He reveals her true nature as a robot to her, which in turn, makes a stunned Rachael act more womanly by stereotypically embodying the roles of mistress and homemaker to appease Deckard. He begins to fall in love with her and eventually they escape together at the end of the film. As Haraway remarks, the replicant Rachel "stands as the image of a cyborg culture's fear, love, and confusion" (1991,178). Consistent with the earlier two decades, the repetitive tropes of female machines embodied current technological anxieties. The film evokes "the angst of artifice and stimulation" mapped onto the female body, in a world where "all human identity is under siege" to survive (Wosk 2015, 118). Particular to this era was the cultural imagination's concern with media's liveness and artificiality, with the ultimate fear of technology overtaking humanity once again. I will return to these notions of artifice and stimulation as it relates to concerns of dancers in mediatized environments. Alongside these issues, the film also still highlights the precarious position of man as inventor, controller, and benefiter of technology.

The male stronghold in computing science created an imbalance of power over technologies and over society at large. Historically in the field of computer science, women entered and received bachelor degrees in computer science starting in the 1960s where enrollment reached a peak in the 1980s. Afterwards, a steady decline of women's participation and enrollment in computer science programs ensued that still persists today (Misa 2010, 30). This also increased gender disparity in the tech industry as well.

Alongside the decreasing number of female students, stereotypes persisted that helped to cement the masculine-dominance of technology, highlighting and championing the figures of nerds, geeks, and hackers. The history of both the development of the Internet (tied to military origins) and the WWW (where the white male geek, nerd, and hacker[xxxix] prevailed), created a fraternity-style ritualized entry in "which young men must prove themselves [while] the presence of women is contested" (Herbst 2008, 53). Just prior to the dot-com bubble crash in the late 1990s, fame and fortune defined the geek subculture, highlighting the stereotypical image of the white, hip, cool guy in the tech industry.

Within the IT sector and other tech industries, the prevailing trope of nerds and hackers "epitomizes a world of mastery, individualism and non-sensuality. Being in an intimate relationship with a computer is both a substitute for, and refuge from, the much more uncertain and complex relationships that characterize social life" (Wajcman 2004, 111-112). From economic success to expertise knowledge, the stereotype of the white male nerd/geek/hacker created a culture of exclusivity and sameness that filtered through all areas of technologically mediated life. As web designer and filmmaker Francis Hunger states, "one of the exclusion mechanisms at work is the broad affirmation of the figure of the hacker, which seems to manifest gender hierarchies" and "deters women from participating in it" (2003, 6). Despite these possible transgressions, an increased focus on and use of technology also presented an alternative platform to investigate subjectivity, identity, and agency in a more productive manner.

From a social constructivist framework, Wajcman details the history of the gender-technology relationship, taking cyborg politics into cyberfeminism. In contrast to Haraway's cyborg manifesto that emphasizes affinity politics, Wajcman critiques technoscience through the delineation of gender binaries, trying to remap the territory through identity politics. For her, the very definition of technology has been cast in terms of "male activities," which, in turn, creates a male professional identity of a computer engineer who is white, male, and middle-class (2009, 144). The male identity promotes mastery and expertise and hence power over the objects rendered in code. In addition, there was and still continues to be the issue of disparity in technological labor fields where "women are being asked to exchange major aspects of their gender identity for a masculine version, whilst there is no similar 'degendering' process prescribed for men" (145). Therein lies a problem with the male domination of technology in all aspects of life, from the initial design of the object to usability. Her pragmatic aim is to draw more women into the design of technical apparatuses, which she views as "not only an equal employment opportunity issue, but is also crucially about how the world we live in is shaped, and for whom" (151). For Wajcman, technology is a sociotechnical product where acknowledging all axes of power through delineations of binary gender codes is necessary for transformation.

The concept of the cyborg opened up the discussion to understand the multiple ways in which, as Wajcman states, "women's lives are entwined with technology…Because it is an aspect of our identity, an aspect of our embodiment, conceiving of ourselves as cyborgs provides

a tool for transforming the gender relations of technoscience" and hence, "challenging traditional notions of gender identity" (2009, 148). To reclaim virtual space, cyberfeminists encouraged and promoted utopic visions of alliances between women and machines (Braidotti 1996; Plant 1997; Wilding 1998), even self-proclaiming themselves as "geek"[xl] girls. Cyborg politics took it one step further.

In the prominently noted imagining of relationality, Haraway's concept of the cyborg advances feminist thought by providing a metaphorical figure as an alternative to traditional ideas around identity and as a critical method to examine bodies, subjectivity, and embodiment. Her argument is "an effort to build an ironic political myth faithful to feminism, socialism, and materialism" (1991, 149). One of her main intentions is to eliminate binaries so instilled in phallogocentrism, including the split between culture/nature, mind/body, male/female categorical distinctions. The metaphor of a cyborg enables one to blur these boundaries and "to contest for meanings, as well as other forms of power and pleasure in technologically mediated societies" (154). Borrowing from women of color feminism, the cyborg is "a creature in a post-gender world" that refutes essentialist notions of unity in gender, race, and/or class and technological determinism by giving space to contradictory subjectivities and transformative potentials (150). The cyborg is not a fixed entity, but a mode to understand fluctuations of power in particular sites and institutions, understanding both its liberatory possibilities and problematic repressive realities. The cyborg provides a framework to discuss the complexities of agency involved in the creation of technological apparatuses and in collaborations of technologically augmented dance performances.

The Trajectory of a Technical Apparatus: Caught in the System of *Isadora*

The details of Troika Ranch developing the software program *Isadora* and the performance of *loopdiver* tells a particular story of an actual lived experience of a female-gendered cyborg. The predicament of the cyborg, at times, breaks down into failure by persistent patriarchal, socio-technical, and historical normative structures. As Haraway acknowledges, "The main trouble with cyborgs, of course, is that they are the illegitimate offspring of militarism and patriarchal capitalism, not to mention state socialism" (1991, 151). But as a mode of analysis, the cyborg opens up the discussion to address the vulnerable position of woman and

epistemic problems in dance tech by acknowledging the importance of embodiment and kinaesthetic knowledge.

To assist in the development of technologically augmented dance, practitioners and/or programmers invented tools (sensors, software, hardware) to manipulate digital material for performers to use in artistic works. Within the fields of electronic music, net art, video and media art, electronic media artist Nell Tenhaaf describes the situation for women artists as a contradiction where the "domain in which they are operating has been historically considered masculine, yet women's current access to electronic production tools seem to belie any gender barrier" (2001, 377). In contrast, Wajcman believes technology does create specific gendered relations based on different experiences men and women have to it. For technology is both a "source and consequence of gender relations", where "masculinity and femininity in turn acquire their meaning and character through their enrollment and embeddedness in working machines. Such a mutual shaping approach recognizes that the gendering of technology affects the entire life trajectory of an artifact" (2009, 144). The trajectory of an "artifact" or the software and apparatuses used in dance and technology works are indeed defined and designed by human subjects and "shaped or reconfigured at the multiple points of consumption and use," but in the actual operations in how they are used and read in different sites produce different accounts of agency and subjectivity beyond such strict categorizations (Ibid.). In a fitting spot for a cyborg, I want to thus turn the creation of the software program *Isadora*.

In unpacking the complexities between the relation of Troika Ranch and *Isadora*, I discuss the trajectory of the artifact, impacting the creative process and performances and the conditions of labor that all reflect upon the real life experiences of cyborgian bodies. To do so, the concept of affective labor, developed by feminist and political theorists, helps to unpack additional forms of labor, "such as nurture and care, which have historically been undervalued or otherwise made invisible" (Myers 2015, 49). In adapting the work of political theorist Michael Hardt, anthropologist Natasha Myers describes the "incredible effort and energy modelers expend to care for all elements of their experimental configuration" (50). Even if these forms of labor have been "overlooked", as Hardt states, affective labor has "never been entirely outside of capitalist production", though this is not to say that they can not also be useful sites to resist and subvert capitalist modes of production" (Ibid.). Modelers perform all types of affective labor, intimate and unrecognizable, to develop care amongst "their instruments, their experiments, and

their objects…as if the very objects of their inquiry were extensions of themselves" (Ibid.). With a focus given to notions of care and to the affective labor practices involved in technological innovation and design, I detail the conditions that arose within TR's development of the software *Isadora*.

Stoppiello and Coniglio both had intimate knowledge and forms of caring in their creative process in relation to technological tools, bodies, and other performance elements. Feminist STS scholar Maria Puig de la Bellacasa defines care as "an affective state, a material vital doing, and an ethico-political obligation," and as a practice linked to devalued labor (2011, 90). To help us examine particular sites of techno-science, the concept of care (Star 1991; Martin, Myers, and Viseu 2015) unpacks the complexities of relations by "not only invit[ing] us to ask, "'For whom?', but also 'Who cares?' 'What for?' 'Why do 'we' care?', and mostly, 'How to care?' These queries can leave open the detection of specific needs for caring in each situation, instead of presupposing there is only one way of caring" (96). In the collaboration of TR, both Stoppiello and Conligio have specific experiences with technology that have led to different accounts of caring within the connection to and development with the devices of MidiDancer and *Isadora* as their growth as artists and in the creation of their performance works.

In one of their earliest works *In Plane* (1994), Coniglio utilized his college innovation of the Midi Dancer system (eight flex sensors connected to a radio transmitter pack) strapped onto Stoppiello's body. They created a duet between Stoppiello and her 'digital double,' a pre-recorded film of her dancing pressed unto Laser Disc technology. With the MidiDancer, Stoppiello controlled the playback features of the video, the audio score (composed by Coniglio), and the movement of the video projector that was robotically controlled on a track in front of the stage. The performance took place on a proscenium stage where Stoppiello danced in front of her projected image on the backdrop screen. Dressed in a unitard in the film and on stage, the work was quite abstract with Horton-inspired movement accompanying stark and jarring electronic snares.

Prior to this performance, she developed her choreographic and creative process at the same time as exploring these technical apparatuses on or around her body in college. At the young age of 19, Stoppiello describes, "working with sensory systems and responsive media was embedded into my creative process from the beginning" (Interview with Horwitz 2014). As a dancer, she trained since a young age in ballet and modern techniques, but her development as a

choreographer occurred at the same time in learning and working with technology.

Because of this synergy of practices, she created a unique movement process specific to the technology to function artistically and conceptually. As Stoppiello explains, "If a dancer is being tracked by a camera, then there is a kind of surveillance going on that cannot be ignored in terms of content. If they are wearing a sensory suit, then there is the addition of the 'exoskeleton' to be taken into consideration" (2009, 172). In detailing her interaction with the MidiDancer, the reciprocal action between the technological device and her movements felts like a type of 'feedback loop'. In this improvisatory act, as she describes it, the experience felt like the "media wasn't separate from me any longer, it was an extension of me, which was curious in one sense since my video counterpart, with whom I was supposedly having a fierce competition, was actually under my control all the time" (Stoppiello with Coniglio 2003, 449-450). Although declaring her power over the video footage, her comment speaks more to an embodied relation between technology and the body rather than discrete entities acting against each other. Stoppiello's choreography during the MidiDancer years was, as she states, "flexion-extension heavy because that was important to me dancing with the system…But I don't think it pushed me…into really new ways of thinking about how to move my body until *loopdiver*" (personal communication 2015). Although she realized the limitations of this device, this was an important moment in regard to how she would continue her work with technology. The behavior of the device motivated her development of movement and of thematic content; she embodied the MidiDancer on stage as well as embracing technology off stage.

To operate the business side of Troika Ranch, Stoppiello also learned how to operate a computer, passed down from Coniglio around 1990 to use for communications via email and to conduct other managerial tasks. They had a website in operation from 1994, unheard of in the dance community at that time. She learned the basics of computers in a practical way, though had a high level of understanding the conceptual potential of computers and additional technical apparatuses to market, archive, and create Troika Ranch's performance works.

Given the male-dominated terrain of technology, it is not surprising the connection to technology for Coniglio. With regard to his creative practice, Coniglio remarks on his early development as an artist and programmer. During college, as technology entwined with Dawn's choreographic process, Coniglio combined his skills of computer programming to music composition. As Coniglio stated, "I started programming computers in 7th grade; I was working

as a professional and designing an accounting system when I was 16. It is just part of who I am. You can't divorce me from computers, you can't" (Interview with Horwitz 2014). In college, electronic music pioneer Morton Subotnick taught and encouraged Coniglio to combine his talents as a programmer and an electroacoustic musician. Being immersed in the climate of experimental and electronic music, his development of the software Interactor with Subotnick and the creation of MidiDancer influenced the direction for Troika Ranch to follow as well.

In 1996, Troika Ranch had a residency at the Studio for Electro-Instrumental Music (STEIM) where they were introduced to Tom Demeyer and Steina Vasulka's software program Imag/ine. This software program allowed the real-time manipulation of video in a performance event. From this inspiration, as Coniglio recalls, "I wanted us to have our own tool that I'm in control of; that I can make sure is absolutely reliable and that will do what I need it to do, when I need it to do it" (Ibid.). The resulting tool *Isadora* is a proprietary graphic programming environment for both Mac and Microsoft Windows operating systems. The program emphasizes the real-time manipulation of digital video, but also has plug-ins to handle external devices for input and output including Open Sound Control, MIDI[xli], Serial, TCP/IP, and HID/game controller devices.

Additionally, through their workshops with the earlier software program Imag/ine, TR realized how little experience choreographers and dancers had with computers. With an incentive to make a tool that would be less complex, more stable, and accessible to novice computer users and programmers, Coniglio started developing *Isadora* to facilitate the work of Troika Ranch with a dancer-user in mind (Figure 25). As the test user, Stoppiello helped in the research and development of the system through their artistic works. As she recalls, "I can be in the creative development of that system because I understand conceptually what's possible, what I want, what we haven't tried but might be possible…I don't write c-code. I don't want to ever but I'm happy to program *Isadora*" (personal communication 2015). *Isadora* was deeply entwined in their artistic practice, their position in the dance world, and their stability as a company.

In their collaboration and artistic goals, the advent of individualized computers afforded the possibilities to play with and manipulate sound and video material more easily. They wanted to explore real-time video feedback in their performance works, but due to the instability of computers and software capabilities, no such technical device existed that was sturdy enough for their artistic intentions. The requirements needed for TR to allow multiple dancers to manipulate

sound and video material was a major factor in starting to develop *Isadora*. Additionally, in a similar experience to Per Biorn from *9 Evenings*, the failure of the machine in live performance also motivated TR to obtain more stability with their technical operations. Coniglio recalls a moment when he was performing in one of their works; the computer system froze on stage due to technical failure in which Stoppiello usually had to cope by continuing to dance. In a switch of roles, he recalls his experience as a performer stating, "and this time it was me, finally, standing onstage in front of 300 people when the computer crashed – and that had never happened to me before" (Interview with Horwitz 2014). Their artistic research, machine failures and personal bodily embarrassment, inadequacy of existing systems for real-time media manipulation, and inaccessible tools for dancers all led to the first version of *Isadora*.

Through their workshops and artistic work, TR was thus the sole operator in advertising the software *Isadora*. Their *Live-I* workshop, started in 1999 and still in various forms today, offers an intensive program to learn the basics of *Isadora* by doing creative, compositional exercises and performing experimentations. All of the factors leading up to the development of *Isadora*, alongside continued development of *Isadora* their creative process of TR works and teachings, complicate notions of authorship and agency. As Haraway describes, "It is not clear who makes and who is made in the relation between human and machine. It is not clear what is mind and what body in machines that resolve into coding practices. In so far as we know ourselves in both formal discourse (for example, biology) and in daily practice (for example, the homework economy in the integrated circuit), we find ourselves to be cyborgs" (Haraway 1991, 177). The particular site of *Isadora* revealed multiple agents in action through different sites and systems.

In the mode of experimentation, dancing bodies through their qualities of movements (range, scale, size, and more) determine the course of action for programming code. Additionally, their corporeality reveal the limits and potentials of technology beyond conventional functions. In *loopdiver*, Coniglio created a specific module in *Isadora* to process five minutes of choreographed movement through different looping structures (fixed, shifting, and growing). The multiple compositions of loops, based upon both Coniglio's ability to program and Stoppiello's directives to choreograph the pedestrian movements, formed the content, but the process and performance was still not complete. The dancers learned and embodied the computational material imposed by algorithmic processes. Additionally, the

entanglement of all these different factors, with additional components of music, scenography, lights, audience, and props, contributed to the overall meaning of the event. As Barad states, "It is through specific agential intra-actions that the boundaries and properties of the components of phenomena become determinate and that particular embodied concepts become meaningful" (2003,133). The meaningfulness is in both the process and the performance, in which, entangled relations between collaborating subjects, bodies, and technologies are typically erased from the literature. Additionally, complications arose by the imposition of structures of authorship, of intellectual property, and of gendered ideologies. Stoppiello recalls that the best moments of collaboration occurred when "all of the material is being developed simultaneously," in which her bodily responsiveness reciprocally acts with and because of technology (personal communication, 2015). The company Troika Ranch, the programmer Coniglio, the choreographer Stoppiello, their place in the dance world versus electronic music, their dependence on financial stability by teaching and licensing *Isadora*, and their use of this device in their creative research and execution of works, in addition to the behavioral actions from the software itself, all factored into the making of this messy hybridity of creative practice and relations between human-non-human phenomena.

When the software program was released to the public in 2002, dynamics started to shift the trajectory of the company and of *Isadora* where particular forms of affective labor were rendered invaluable, contributing to the breakdown of the cyborg. At the beginning of their collaboration, Stoppiello describes their partnership,

> So I was like this fabulous flashy dancer with this kind of geeky nerd walking behind me. But Mark had his own sense of flash, let's say because of his innovations already at that time. And then we were Troika Ranch and we were this kind of equal dynamic duo, power couple and that lasted for ten years or so…It was a good pairing of our skills but at some point I felt the focus tip from being a kind of dance company to being a media machine and I felt eclipsed by him at a certain point (personal communication 2015).

When Coniglio started developing *Isadora* around 1999, Stoppiello left all her day jobs (such as teaching Pilates) to focus on developing the company Troika Ranch. They were married at the time, living and working together in Brooklyn, New York. She managed the house and the company Troika Ranch "to create an environment in which Mark could sit at his desk and be the genius programmer" (Ibid.). As she recalls, "I was feeling undervalued in my participation in *Isadora*, the development of it. And Mark would say, 'well you didn't write any of the code" and

I'm like, 'no, I didn't write a line of code but…. I was there supporting this effort. I was making sure the machine of the company was going." (Ibid.). Echoing sentiments voiced by the artists from *9 Evenings*, Stoppiello raised a tension that occurs when labor roles cause an imbalance of control and value to the work being done. Additionally problematic are the economic constraints where tangible artifacts like software programs (compared to the vanishing act of dance) provide an easier commodity for economic gain (patents, intellectual property, products) in the current capitalist system.

This does not mean forms of care were rendered invaluable; both had incredible stakes in the creation and use of this device and in their collaboration as a company. As feminist STS scholars Aryn Martin, Natasha Myers, and Ana Viseu remind us, "the forms of care…need not be motivated only by warm feelings of love, affection, or nurture. Care is just as often propelled by anxiety, injury, injustice, indignation, or frustration" (2015, 6). Stoppiello felt caught in the system of *Isadora*. The tensions between both her and Coniglio increased, revealing the complex and messy dynamics of collaboration and of different systems in play. They decided to legally divorce in 2009, but continue their working relationship as collaborators of Troika Ranch. Stoppiello discusses this moment of decision, outlining her value in the creation of *Isadora* and of their art through painful negotiations. She recalls her conversations with Coniglio to mention her side,

> I'm not saying I'm entirely responsible for anything… but how do we split up this business that you've created that you think I have no part of…If you had just said actually Troika Ranch is part of developing Isadora because everything that you did, in a piece of ours, that we made together, eventually turned into an actor that you put in Isadora. This helped develop the software through your own creative efforts and mine, ours together (personal communication 2015).

This is not to say this was not difficult for Coniglio as well. This shift altered how people perceived him as well. As Stoppiello remarked, "when people meet him they say, 'Oh, you're the creator of Isadora,' they don't say you're that composer artist guy and that's really hard for him because his whole identity has now changed (personal communication 2015). In the process of figuring out how Troika Ranch would function and how they would split assets, another legal system contributed to their decision. Under the New York State law of equitable distribution, if a couple starts a business and then divorces, a fair and equal division of the assets' value is granted to both parties. Instead of going through a tedious, expensive, and long audit, they came to an

agreement where Stoppiello asked to be bought out financially from her remaining ties to Coniglio. There is no doubt that Coniglio is the programmer of *Isadora*, but within collaborations of multiple agencies that have real direct effects on economic compensation and livelihoods, navigating such terrain is indeed a messy business.

Currently, Coniglio's company TroikaTronix dictates the trajectory of *Isadora*, where he supports a diverse team of programmers to assist him in the development and upkeep of the software program. At conferences and academic institutions, he speaks about his art practice and development of *Isadora* and teaches highly technical workshops utilizing *Isadora* for media art projects. Stoppiello teaches workshops that utilize the program *Isadora* for creative performance practices and uses the software in her own performance work. For my concern, I question how can we imagine a system that fairly and equitably appreciates the contributions coming from both the worlds of technology and of dance. A first step towards transformation is to recognize these problems, to give voice to the parties hindered by these systems, and to change the language surrounding this discourse for more imaginative and hopeful possibilities. A focus to care and affective notions of labor does not offer solutions to these problems, but gives space to acknowledge the contributions of dancers as coders.

***loopdiver* continues…**

The three rotating platforms of screens in the middle start to move, rotating and expanding in form from one screen to two screens. In the elongated formation, the screens create a blockade, cutting the stage into two divided spaces. Ghostly images of the performers start to appear on the screens looping movement, while, at the same time, their physical bodies lay sprawled on the floor starting another looping structure of tossing, turning, and slowly trying to stand up. The music supports this exchange, as it attempts to reach some form of melodic phrasing out of the repetitive looping structure it inhabits too well. Alas, the looping structure continues as the dancers face their virtual double, repeating the gestures of rubbing the neck, touching the shoulder, reaching for the sky, and more to an excruciating level of discomfort shown in their faces and muscular tension. Blackout.

The ghostly figures run up to the edge of the screen to initiate a looping of the previous section. The screens go blank. The dancers escape out of the confines of facing the screens and

expand their looping structure of walking, looking, and occasionally partnering up to complete the repetitive gestures enacted. Blackout. A shift of focus to all the materials looping at once begins; lights, sound, movements, and screens increase to a hypnotic, strobe-like climax. Slowly calming down and in sporadic timing, each of the elements now responds in a loop or eliminates themselves from the loop by holding still. All the while, the screens start slowly folding back together, returning to their initial position by the time the performance ends.

Dancers in Code: Interactivity, Audience Reception, and Gendered Subjectivity

From the 1980s to the early 2000s, scholars and artists in the field of technologically augmented dance performance debated on what the processes of computation were contributing aesthetically and creatively to the production of movement. The technologies were considered "neutral" tools, the performing body transformed into an instrument, while performers and audiences alike controlled the media in interactive environments. The discussions, terms, and areas of interest for this type of interaction originated from the field of computer music[xlii], possibly allowing one to overlook key differences between music and dance in the creation process, with the bodies involved, and in the performance event.

Particular to my concern is what happened when digital technologies merged into the frameworks of dance and for dancers. A range of confusion occurred about the merit of such work in regard to the potential of a new aesthetic and to the critical possibilities to reimagine better relations between technology and the body. Propagated by dance critics, theorists, and artists, "bolder conceptual ideas that might have employed digital systems to a more potent aesthetic effect" instead took the path of "covering up conventional dance performance with layers of superficial digital icing" (Salter 2010, 263-4). There was a possibility of digital technologies and hence, the more open systems shifting hierarchical relations of power, but this does not materialize whole-heartedly in the academy, in the industry, or in the arts.

One of the problems when discussing interactivity was agency given to humans to control technical apparatuses. In this move, discussions oddly framed a duality of media as either alive or dead, placing emphasis on the human subject controlling media to match the quintessential characteristic of performances: the momentary action of both appearing and disappearing. The direction of control was from the body to the media by the mapping of inputs and outputs,

derived from the processes of gesture-driven computer music rather than through the whole dancing body's range of movements and emotions. This has been discussed before (Downie 2005, Birringer 1998, Rodgers 2010), although rarely from a gender point of view or dancer's perspective. Additionally, the (in)visibility of mapping to the audience was heightened as a concern for their inability to derive meaning from this interaction.

The debates fluctuated between supporting the disembodied, abstracted practice of technology to the determinant of the corporeal, kinaesthetic elements of dance at the intersection of cybernetics, technoscience, and artistic practice. In defense of the latter claim for dance, performance scholar Johannes Birringer cautions that technology can never capture the full "spatial and context, movement pathways, and relative positions of all dancers through time, nor can they adequately compensate for body heat, sweat, breath, and visceral and tactile feedback" (2008, 82). Within this emergence, multiple perspectives from artists and scholars elaborated on the significance of bodies in mediated environments, raising issues on both the role of interactivity and, in the more feminist scholarship, of subjectivity. Haraway's notion of the cyborg, Myer's notions of affective labor and care, Wajcman's sociological critique of technology, and Barker's sensorial approach to film all challenge epistemological and ontological frameworks in dance tech to understand the contribution of dancers' kinaesthetic knowledge as forms of coding.

In recent analyses of TR's work, a clear focus resides in their use and development of technical innovations and their music-centered approach to interactivity (Dixon 2007; Broadhurst 2008; Birringer 2008; Salter 2010). With reference to interactivity and audience awareness, Coniglio raises the concern that digital media can "be endlessly duplicated and/or presented without fear of the tiniest change or degradation" (2004, 6). The media's "deadness" presents the problem for it is "antithetical to the fluid and ever changing nature of live performance" (Ibid). Interactivity exists between the performer exerting control over the media as a way of "imposing the chaos of the organic on to the fixed nature of the electronic, ensuring that the digital materials remain as fluid and alive as the performers themselves" (7). This implies that the performers must be able to improvise with the media to take advantage of the abilities afforded by technology. In order to explain how this interaction takes place, he creates an analogy to how composers conduct classical orchestras. The conductor exerts control by his or her own gestures to direct changes in the music by two major parameters: timing and dynamics (8). In a live

interaction, the performer similarly uses his or her gestures to control the "pre-composed media materials" and that even if the parameters might "be limited", the "range of those manipulations must be profound enough to allow the performer to place his or her personal interpretive stamp on the material" (Ibid.). The focus of interaction relies on the ability of the human to control media for aesthetical dimensions in the performance.

Furthermore, the importance of creating interactive works is the addition of technology as another "layer of liveness to the experience" and if the audience does not understand this, they are missing an essential facet of the piece (10). In most cases, audiences also don't understand the internal dynamics of improvisation between human performers either --however, they are aware of a certain degree of "liveness" taking place. This is harder with computer-driven and interactive media because the behavior of such media always feels less than lively. Nevertheless, audiences still interpret actions of the event given to them, whether they have knowledge of the process or interest in the materials. Coniglio's previous fascination views interaction from a computational point of view, focusing on the symbolic interactions over embodied intra-actions that maintains problematic binaries of liveness vs. deadness, human vs. machine, and presence vs. absence. Theater scholar David Z. Saltz critically reminds us, "Perhaps the current fascination with interactive technologies is, in fact, part of the reaction against postmodern alienation, a nostalgic revival of the modernist quest for presence and immediacy" (1997, 125).

In trying to understand the dynamics of interactivity in performance works, Saltz argues for computer art's ontological alignment to performance by reconciling their differences through interactivity. In merging interactive technologies and performance art, the combination both complicates the "idea of the 'author' and the identity of the work" (1997, 117). He defines interactive work through three actions that must occur in real-time: "a sensing or input device translates certain aspects of a person's behavior into digital form…the computer outputs data that are systematically related to the input, and the output data is translated back into real-world phenomena that people can perceive" (118). Although he still problematically questions, "Is interactive media itself "live" or not?," he raises some valid concerns for my discussion and productive ways to imagine interactions of media and performance art (2001, 127). One concern is the merging of seemingly oppositional characteristics between the 'immaterial' objects of technology to the physical presence of performers.

In this new realm of virtuality, a dualism between the materiality of the body and the

immateriality of information is reinforced, forming a hierarchy in which information has the dominant position. As postmodern literary critic Katherine Hayles explains, "although researchers in the physical and human sciences acknowledged the importance of materiality in different ways, they nevertheless have collaborated in creating the postmodern ideology that the body's materiality is secondary to the logical or semiotic structures it encodes" (1999, 192). The problem also persists in the merging of interactive computational processes to performance practices.

In theater, dance, and other modes of live performance art that incorporate interactive technologies, "what the performers are performing, remains logically distinct from the interactive system itself" (Saltz 1997, 124). A problem arises if the interactive computer artists are stuck in the realm of ideas, "creating logical structures in the medium of software. Interactive computer art, however, can never exist only as software. The work must reach out into the world in some way to capture the human interactor's input; the interactor must either make physical contact with a physical object or make movements within an articulated region of real space. And the work must project some sort of stimulus- sound, image, kinetic movement-back into the world for the audience to perceive" (117-118). Saltz views interactivity as providing an opportunity to "grant media real agency, casting them in a role on par with the live performers" (2001, 127). Although he fails to mention the stakes involved in the process of interaction to gendered subjects, he discusses the importance of materiality and agency and hints at ideas around embodiment, all to create productive modes of interactive performance environments. The interest of these types of works is in the action of the event itself, "in observing the development of a unique relationship between system and human" (1997, 124). An embodied process between information and materiality can resist this division and imbalance of power, shifting the focus from individual entities to the actions that are performed by all human-non-human phenomena.

From a female perspective, and involving a similar gendered partnership to TR, dancer and choreographer Susan Kozel argues for the place of embodiment in technologically augmented dance performance using *Telematic Dreaming* (1992), a collaboration with interactive media artist Paul Sermon, as one of her case studies. Kozel's writing is informed by her experience as a woman and dancer, "questioning the materiality, perception, ethics, flesh, and affect of computational systems" in dance tech works (2007, 65). She frames her argument

through phenomenology by focusing attention to "embodied materiality" that allows a productive, critical framework to address assumptions about both bodies and technology in performance works. Kozel defines the body as a "weave of different materialities, the body is a dynamic process, the body navigates the world at the intersection of a cluster of languages (verbal, physical, archetypal, mnemonic, unconscious). It is electric, biological, and cultural…bodies extend beyond ourselves through the operation of our senses" (33). In a counter-argument to misrepresentations of the body in virtual space (rendering the body obsolete or replacing the body through enhancements), Kozel develops an attuned sense of how embodiment and kinaesthetic knowledge can address problematic imaginings of cyborg bodies.

As a performer in the work *Telematic Dreaming* (1992), Kozel analyzes the effects telepresence had on her physical body interacting with her virtual self and others. The stage design consisted of two separate rooms with a bed in each with video projectors and monitors. Kozel was in one room on the bed, while her virtual image was projected onto the other bed in the second room. Visitors could interact with her virtual body and vice versa. This performance was pivotal to her exploration of a phenomenological method; writing and reflecting upon her experience in the moment of living through the event to understand the body in technologically mediated environments. Her analysis gives room to aspects of bodily notions of touch, trust, pain, vulnerability, and care that all occurred within the confines of the three-dimensional and virtual space. Elements of touching virtual hands on the other side of the screen opened up "tender and intimate interchanges" creating a "powerful link between the body on the screen and the bundle of emotions, thoughts, and movement that make up [her] material body" (94). The restriction of movement to the bed and to the screen caused physical pain to her body. She felt pain in her back and neck, numbness in her right arm, and overall muscle tension in the lower half of her body. Her bodily functions became a significant source of intrigue, questioning her digestive systems and breathing techniques. She felt "pulled between the two extremes of an imaginary spectrum: the abjection of flesh and the sanitization of technology" (86). Although mostly a positive experience, in one particular situation, she separated her virtual self from her own corporeality, an instinctual move of self-care and protection that speaks to the fragility of gendered bodies.

During this action, two men attacked her virtual body by striking her head and pelvis. At this moment, she recalls watching this happening on the monitor as if this was happening to

another woman's body. This moment was quite revealing in understanding how impactful violent acts cause harm, even in virtual space, and how difficult it is to create solutions to "entrenched chauvinism" (102). Although giving space to unpack the materiality of the body, Kozel's experience reveals the breakdown of the cyborg body. In moments of heated intimacy or violent acts, she decided "to ignore the monitors" connecting back to her corporeality as her "dance partners simply did not exist" (102). Kozel refers to these moments as enabling and "challenging existing ideas of what is was possible for two bodies to do" as she clarifies by being "projected onto the other, or even disappear by placing my body within the frontier of another body" (103). In understanding the dynamics between the virtual body and the physical body, technology becomes an extension that adds to the body's existing capabilities, not something that can replace or remove it. In her analysis, Kozel counteracts such claims that "virtual technology demonstrates the futility of the body" by proposing instead that this experience creates an extension of the body (McLuhan 1964) where the "virtual body is entwined with the fleshly body…reinforced by [her] experiences of intimacy and violence" (99). She sees potential in virtual space as an opening to address social conditioning and prejudices that might occur, but offers no pragmatic solutions to disrupt these acts in the moment or from happening at all. Her gender certainly factored into how the performance unfolded, but only in particular heated moments did she address how her subjectivity was at stake with a strategy of removing her presence from the situation altogether[xliii].

Through the lens of STS, I believe a more thorough investigation of how all the different factors influenced problematic notions of agency and subjectivity is possible, even unpacking the actual collaboration with male, interactive artists (such as Paul Sermon) and his role in the process and final execution of the performative installation. The place of the gendered body in digital code was indeed fraught with problems, but attention to the materiality of the body helped to understand part of the complexities of being immersed in a technologically-mediated environment. Kozel's argument focuses the attention back to the body, acknowledging that cultural and social constructs still restrict and dominate the otherwise fruitful and exploratory state of working with technology.

Additionally, Anna Munster argues for the importance of the materiality of the body in computational spaces of interfaces, noting that Haraway's cyborg has incorrectly been associated with the domination of digital technologies and culture and with popular visual representations

rendering and literally creating such images of "circuitry encroaching upon or into human flesh" (2006, 185n5). For example, performance artist Stelarc boldly proposes that the human body is obsolete. His performance works follow a trajectory of "the invasion of the body by technology", pushing his body to the edge of depletion, where as he states, "'What becomes important is not merely the body's identity, but its connectivity—not its mobility or location, but its interface'" (134). Cyborg imaginings, represented by Stelarc, have literal renditions that still bring about an opposition between the human and machine, where "one side will always be required to conjoin with or eradicate the other," in addition to the totalizing account of 'the body' (Ibid.). His body is in a position of privilege as a white male, consciously avoiding the reference of himself as a subject, a choice not given so easily to women and minorities (Ibid.).

Additionally, "most figurations of the cyborg and theories of posthumanism treat body and code as predefined unities that impinge upon and assimilate one to other," creating incorrect notions of what it means to capture bodily data into code, "and yet living with contemporary digital machines produces instead everyday encounters of doubling, splitting, and reverberating as new aspects of our bodily experiences" (31). During the process of rendering the body into data and code, the "embodied self" has to confront its dematerialized rendering in computational space, where an imbalance of control favoring the "information pattern over the matter" could occur, but "our bodies are immanently open to these kinds of technically symbiotic transformations" (19). Munster proclaims when the body is rendered into information, we create a feeling of mapping ourselves, a "strangely distant or removed *and* immediately intimate" experience (142). The transformation occurs through the affect produced by relationship between these different materialities and not how they augment each other. A renewed focus on the body challenges the "pace, interaction, and relations we have and are capable of sustain[ing]" with machines (185). Munster calls for embodiment in the digital, where the rendering of bodies into code can be rethought of as "lines of expression", following Pierre-Félix Guattari's reading in cinematic aesthetics where "parallel and intersecting lines of color, vision, and sound...function to create a complex spatialization" (139). Furthermore, the qualitative, affective elements from these interfaces can be excessive to an audience, like that of viewing a film, where spectators cannot absorb all the information from one screening alone. This effect creates an activity of composition when audiences view, engage and sense the aesthetics of the work. Embodiment occurs in those spaces, of interfaces, moving in the gaps, the folds, the space of exchanges inside

and outside matter and code, creating aesthetic processes by focusing on the composition instead of representation in real-time.

In more productive discussions, interactivity enabled multiple agents to shift the behaviors and effects of a performance event, by the directors, performers, technical objects, and audience experience. In reaction, an emphasis on defending aspects of the qualities of dancers emerged, as computational processes and media outputs would never be able to render the complexity of movement, experience, and emotion, acting as extensions or as supports for the moving body. A more attuned focus to elements of embodiment and subjectivity reformulated these discussions to accurately discuss the nuances and complexities of technologically augmented dance. As these debates continued in more academic circles, Troika Ranch was exploring these issues practically within their various artistic works.

loopdiver **concludes…**

Halfway to completion, the performance continues on. The movements of the performers become more elaborate, running together in a loop across the stage to collapse back down on the ground. More partner work continues. An urgency and exasperation exudes in the air, yet at the same time, this moment links together the performers more directly than any other time; not only in their movements but also spatially by being in one row from one side of the audience to the other. They move back and forth across the stage in this formation with more complicated contemporary dance movements still in repeat, an aura of exhaustion settles into the space. They return to their chairs, repeat, go back into the row formation, repeat, go back in front of the screens, repeat… as if each object pulls them back magnetically to this force of looping.

Eventually, one female performer snaps out of it, exploring the space as for the very first time. The screens start to show images of blinds blowing in the wind while the rest of the performers are continually looping the pedestrian movements of walking and other everyday twitches. The same voice we heard from the beginning is in the flesh. From the audience, she speaks into a microphone in a mix of French and English of her experiences in the loop, ending on repeat with, "I start again, back to the beginning… always, again, encore, encore, again…" The performance ends.

The Performance of *loopdiver*: A Female-Centered Experience of a Cyborgian Body

The year that TR began the investigation into *loopdiver*, Stoppiello was turning forty-years old and remembers, "I was feeling like my life was a loop. I had been looking at that same clip that goes out as part of the *Isadora* files with the software that is me from 1993… a million different ways forever and it was on my mind and Mark's as well" (personal communication 2015). The technology captures her image as long as that version of software is in circulation and use, while simultaneously a huge traumatic shift was occurring in her artistic, personal, and professionally life. At the tipping point, Coniglio and Stoppiello began to separate personally in their lives and take part in different trajectories of the multimedia performance field. At one point, Stoppiello became frustrated by the idea that, even though they were a company together, dance conferences, academic institutions, and other venues invited Coniglio and not Stoppiello. As she recalls, "they want to talk to the technologist about the dance not the dancer about the dance" (Ibid.). As technology was dominating the conversation personally and in the larger context of the field, her need to express her lived experience under the changing conditions was one possible thread to start work on *loopdiver*.

The imaginative possibilities of art offer a platform to counteract "female invisibility in the discourses of technology" by the ability to, as Nell Tenhaff elegantly vocalizes, "develop images and tropes that are body-based in any way that opens up an affirmative space for the feminine in electronic media practices. My hypothesis is that autobiographical, metaphorical, even mythical feminine enunciations in this domain contribute to an unwriting of the masculine bias in technology" (Tenhaff 1995, 378). The work of *loopdiver* was Stoppiello's experience as a cyborgian body in a technologically mediated world.

After the initial in-progress showing, two dramatic changes transpired: Stoppiello performed in the work (in their previous works, she did not perform, but acted as co-director and choreographer) and the female, French performer Levy, was the only speaker during the performance (Figure 26). Her pre-recorded voice resonated in the beginning of the piece to the conclusion of her speaking live on stage about her experience in the loop, "to remind them that [these] subjects continue to take up space, to suffer, to think, to desire, to experience" (Jones 2006, 135-136). Additionally, in choreographing *loopdiver*, TR departed from more abstract, codified modern movement vocabulary that can be perceived as inaccessible to the average

spectator to more pedestrian-style gestures to fully capture the powerful effect of the loop. All of these changes significantly departed from the group's earlier works that emphasized magic and spectacle to the everyday human condition in a technologically mediated world.

In their earlier works, like *In Plane* (1994) and *16 [R]evolutions* (2006), both Stoppiello and Coniglio discussed their problematic relationship of interactivity with visual projected material mapped by the dancer's body (Figure 27). Stoppiello and Coniglio became enthralled with the seduction of video. The abilities of video "can do things we cannot do in real life" as there is an "enticement" and "amazement" with the possibilities of video, but also in contrast, video is "trapped on the black wall" as well (Interview with Solano 2012). Stoppiello describes her experience working with film as an "amazing, magical, beautiful visual material that could accompany the dancer," but eventually became "'the thing'…that dominated the products…[getting] a little saccharine after a while, or a little like, Oh this is just another gorgeous video thing…move those dancers out of the way so we can see it please" (personal communication 2015). As Coniglio adds, "Dawn was creating these beautiful images, blurred and ghostly, and who is looking at Dawn right now, nobody" (Interview with Solano 2012). The projected visual material eclipsed the presence of the performing body by scale, intensity, location, and other dynamics. An issue that relates back to the electric era, the filmic presence on-stage could either amplify the fragmentation of the human body, extend the body, or replace the body altogether.

In a similar discussion focused around more text-based theater-based works, Parker-Starbuck emphasizes that when "immersed in technologies, the body may feel disorientated, awestruck, thrilled, uncertain. Whether in an immersive 3-D [space]…or bombarded on stage by lights, projections, and the sound, the actor and audience alike strive to find an equilibrium within the experience, a task that is not always easily assumed" (Parker-Starbuck 2011, 160). The issues of control and domination were constantly up for debate, shown through both Kozel's experience and Stoppiello's comments of their bodies immersed, or, at times, bombarded by the large projected image of her digital double.

The screen and performer can co-exist and create interesting dialogues of feedback with thoughtful attention towards what the materiality of film (disruption of time and space, camera angles, and more) brings to the overall intention of the work. Additionally, the components of what is being filmed, who had directorial control, why the image is in real-time or pre-recorded,

and where the image is placed, all are crucial to evade objectification whether on screen or on stage and to give space to all agents in their ability to behaviorally change the environment. As Coniglio has later reflected on this interaction, "the media often functioned as a kind of 'super-scenography'; it contextualized the dances, but did not deeply attack or redefine our experience of the body in motion" (Troika Ranch 2008, 3). The behavioral changes necessary for all agents to act did not materialize.

The work of *loopdiver* transcended TR's seduction with visual, real-time manipulated filmic imagery by creating different strategies to incorporate a more critical and affective incorporation of media with performing bodies. Haraway warns that "The machine is not an 'it' to be animated, worshipped, and dominated," but instead, a part of us, "our processes, an aspect of our embodiment. We can be responsible for machines; they do not dominate or threaten us" (1991, 180). TR creates a balance between the image on the screen and the performing body moving. The screens hold their perfected digital double looping, giving agency in their ability to represent the perfectly looped computational algorithm of their recorded dancing body. What's more, the separation of time and space given to both the real, breathing dancing bodies to the film bodies, allows the audience to viscerally experience the power of both types of experiences and draw their own meanings by the actions in the event.

In one such analysis of the *loopdiver*, theater scholar Roger Bechtel views the work as a reflection of trauma, "an affliction not only of the psyche, but also of the body" (2013, 77). In opposition to the popular aesthetic imaginings that highlight the dramatic and stereotypical representations of trauma, he argues that the work offers a different perspective grounded in the "embodied experience of trauma, from quotidian disquietude to wrenching anxiety" and "provides an exemplary instance of a performance that both explores and depends on kinesthetic empathy to achieve its effects" (77-78). In the moments of excess, both dancing bodies and filmic bodies embodied experiences of trauma, giving space to the audience to reflect and engage with the creative content of the work.

A traumatic event leaves permanent scars (physical and emotional) on the body. The mind tries to shield the body by preventing a memory to occur of the actual moment of trauma. The traumatic experience, as Bechtel elaborates, is "trapped in the body" or 'possesses' the body (Caruth 1995), where "this somatic hyperarousal is precisely what prevents the cognitive assimilation of the experience, producing an infernal loop of mind and body – the former

attempting to claim the experience, the latter responding ever more defensively to these attempts" (2013, 77). The trauma 'possessed' in the body also produces symptomatic behaviors, released outwards only to loop back into the body experienced by "flashbacks, nightmares, anxiety, and behavioral compulsions and tics that prevent the traumatized person both from owning the past and living the present" (Ibid.). In *loopdiver*, the performers embody trauma; twitching, tensing, falling, reaching and retracting only to repeat again into behavioral compulsions specific to their own personal experience and way of moving (Figure 28). Their filmic body double also embodies trauma, literally repeating the algorithmically perfected looped dance within the same space.

As communication scholar Jennifer Barker elegantly asks, "How is it that our experience of the film's bodily movements and the space in which it moves is so powerful, so *moving?*" (2009, 84). In a discussion delineating between the human body and film's body, Barker adopts a more tactile approach in understanding the particular ways these two bodies function: haptically, kinaesthetically and/or muscularly and viscerally. The human body enacts haptically at the surface through skin and touch, kinaesthetically by the qualities of the muscles, tendons, and bones, and viscerally "in the murky recesses of the body" (3). In the combination of these three entities, bodies touch upon the film to "receive, respond to, and reenact the rhythms of cinema" (Ibid.).

The film's body also reciprocally and intimately acts to the outside world by these three functions. As Barker eloquently defines the three ways: "haptically, at the screen's surface, with the caress of shimmering nitrate and the scratch of dust and fiber on celluloid; kinaesethetically, through the contours of on- and off- screen space and of the bodies, both human and mechanical, that inhabit or escape those spaces; and viscerally, with the film's rush through a projector's gate and the 'breathing' of lenses" (Ibid.). For at the end of *loopdiver*, when the screens collapse together again with a lasting image of a blowing curtain, a breathe of air circulates and permeates the tense-filled bodies of both the performers and audience (Figure 29). A sense of calm by the film's images and by the escape of the one female performer resonates throughout the space, although with no definitive resolution. The female dancer ends the performance speaking her concerns about her particular cyborgian experience in the looped structure of the film, her vocal traces trailing onwards.

Conclusion

"As the (generational) effects of global capitalism, genocide, violence, oppression and trauma settle into our bodies, we must build new understandings of bodies and gender that can reflect our histories and our resiliency, not our oppressor or our self-shame and loathing… That moves us closer to bodies and movements that disrupt, dismantle, disturb. Bodies and movements ready to throw down and create a different way for all of us, not just some of us."
Mia Mingus 2011.

loopdiver was an incredibly moving performance, partly autobiographical and hugely emotive, that transformed the way Stoppiello, Coniglio, and Troika Ranch defined their identities, ideologies, and methods of practice. In their twenty years of working together, Troika Ranch's work and their individual trajectories are emblematic of their time from the 1980s to the present. Their story paints a picture of two highly talented people coming together to create dance and theater works with the influx of digital media. In the telling of their story, aim to do justice to what feminist Kelly Oliver elegantly proclaims,

> We need to reconceive of power relations such that empowering one is not disempowering another. In order to imagine and create democratic political relations, ethical social relations, and compassionate personal relations, we need to work-through performative repetitions of 'us versus them' notions of subjectivity and identity towards conceptions of subjectivity and identity that acknowledge not only the ways in which our dependence upon others causes pain and subordination, but also the ways in which our dependence upon others gives birth to and nourishes our imagination and innovative capacity to find meaning in life (2003, 187-188).

The story of the development and trajectory of the software *Isadora* needed to include the contributions of dancers. In collaborative artistic practice, different forms of agency (company, performance works, technology, dancers, and more) affect the outcomes and aims of particular sites and situations. In the messy and complex world of human relations, attentiveness to the body, emotions, feelings, and sensations must take place. In specific aspects within TR's research and development process, the liberatory possibilities of the cyborg shut down by the unrelenting historical and socio-technical inscribed gender roles and paradigms. Yet, Haraway's concept of the cyborg also offered a different critical and methodological approach that allowed room to take into account the body and its contributions of kinaesthetic knowledge back into the narrative.

In the messy entanglement of collaborations, power asymmetries still existed, fueled particular in this era by normative systems of control. Empowerment seeps in and out of people's lives at various times, but the importance is to recognize who is at risk, from whom, and how can this change positively for all parties. As Stoppiello elaborates, "confidence and trusting yourself, trusting your own perception of a situation. That's when I feel the most empowered…But that's been something I've had to struggle with a little but in terms of feeling who is the more empowered person in this collaboration" (personal communication 2015). In a similar response, Coniglio boldly remarks, "I want to empower, I want to give the power of doing media, interactive media, real time interactive media control to people that are not programmers" partly because, as he continues, "I guess the reason that I want to empower people, the reason that I want to champion the underdog is because I feel like I am one of those people in my own way" (Ibid.).

In recent work, both Stoppiello and Coniglio have readapted different strategies in their separate and joint processes of creation and dissemination. For Stoppiello, her performance works started shifted from large-scale productions to more intimate, site-specific encounters. In her series entitled *Salon du Garage*, she produces free performances inside her garage and home in Portland, Oregon. The performances are "highly improvised and very playful with no exclusive pretense," where as she states, "With this series I want to expose a broader audience to contemporary dance. I want to have fun. And I am" (Stoppiello 2015). At the present moment, she is more interested in "subtlety, energy, mystery and intention of action" where experience of the moment and accessibility of the movement is crucial to give validity to audience's independent thought and feedback (personal communication 2015).

Coniglio has a current concern of people's lack of empathy that seems encouraged and common amongst the mediums of social media and other forms on the Internet (Ibid.). In their next collaborative work *Swarm* (2015), he wants to investigate audience participation and interactions through facilitators and operators giving directives by in-person interactions, text messaging, and other devices to explore forms of empathy and community-building techniques. *Swarm* is an interactive installation where key performers initiate actions for the audience members to follow by visual clues (Figure 30). The audience members identify a specific symbol of their choosing before entering the space and are directed to follow those projected images throughout the performance. In an open spatial concept, audience members, in turn, create

movements themselves directed by text messages received by Coniglio during the performance, that in turn, create the narrative, development, and movements of the work.

TR describes the work as,

> The crux of SWARM is that only through coordination, conversation, and collective action can the audience – the "swarm" – reveal the fullest and most complete dramatic arc of the piece…In this way every performance is in fact also a rehearsal. The unpredictable nature of audience behavior coupled with their attempt to follow the simple instructions creates a group complexity of movement that cannot be intentionally configured (Stoppiello and Coniglio 2016).

Coniglio wants to confront the idea that, as he states, "electronic media has put a kind of barrier of feeling" where it allows "people to disassociate themselves from the actually profound impact that they can have upon another person through the words they say" (personal communication 2015). Through making the audience responsible for their actions alongside the performers and technical apparatuses, they are currently on an interesting trajectory to truly explore the agential elements of all participants by opening up the intra-active spaces of collective possibilities with digital technologies in a critical and more productive manner (Figure 31).

Chapter 4: *Orbital Resonance:* Feminist STS Methods as Creative Practice in the Millennial Era

The Performance Event: *Orbital Resonance*

The performance begins. Wearing black attire and wireless microphones, four performers randomly take their positions in space. In blackness, audience members start to enter. There are no designated markers to indicate where the audience should go, but equipment and theater lights frame an area of interactive technological responsiveness not yet activated. Due to sensory deprivation[xliv]*, the audience cannot see where the performers are located, and thus a shift in their emotional state and awareness occurs. To focus, the audience tunes in to their own breath and that of the performers' unamplified breath to situate themselves in the space.*

Progressively, the performers' improvisational breathing amplifies, filters, and spatializes in real-time throughout the space, becoming vocalizations. Audience members are free at any point to move around the space. A faint spot of light gradually appears on the bodies in the space, continues to follow and react (by expanding and contracting), at random, to one performer's voice at a time. The section reaches a climax in volume, and focus shifts immediately to two elevated wooden platforms, which vibrate sine waves and pulse light as instructed by the inputs of the performers' heartbeats. Eventually, the performers, too, start pulsating, initiating further improvisations in movement and in sound (Figure 32). *The interactions among movements, sounds, architecture, lights, performers, and spectators all become blurred in the co-creation of situations within the responsive environment. The performance ends.*

The Description and Dissemination of *Orbital Resonance*

Orbital Resonance is a research-creation project that applies feminist STS methods (Barad 2007; Haraway 2008; Myers and Dumit 2011) in the creation of movement, in the design and use of technology, and in the performance event with collaboration by a multiplicity of gender identities (cis male, queer, gay, and technofeminists) and expressions. The work

externalizes internal physiological states of the body by displaying them as elements of light and sound in an immersive sensory environment. The performers improvise with sound and movement through breath, voice, and body-based sensors, including an x-OSC wireless microcontroller, Pulse Sensor, Muscle Sensor, and Heartbeat transmitter. The larger environment merges the interactions between multiple elements (audience, performers, light, sound, architecture, sensors), replicating an orbital resonance, the phenomenon when two or more orbiting bodies become in synch or unstable in relation to each other.

The project was created in collaboration with Greek interactive media developer and creative engineer Nikolaos Chandolias, with participation from American experimental musician, sound artist and researcher Doug Van Nort and French transdisciplinary researcher, dancer and multimedia queer-identified artist Anne Goldenberg. Our diverse cultural backgrounds provided both the opportunity to engage in an interdisciplinary, collaborative process and the setting to explore gender as a focal point, with the goal of breaking down gender binaries through skill-sharing and through the performance itself. By skill-sharing both technological and body-based practices, we became co-creators, co-operators, and co-directors of the overall design and structure of the performance. In turn, our combined expertise defused individualistic and auteur aims to focus on a more detailed investigation of the stakes involved when incorporating particular technologies and effects.

In *Orbital Resonance*, Chandolias and I collaborated in every aspect of the process: initial research questions, conceptual and creative content, technological research and development, workshop and rehearsal directives, set-up of space and scenography, organization, promotion, documentation, and all other tasks. Van Nort and Goldenberg participated at specific rehearsal days to assist in workshops, conceptual and technological development, performance creation, and production of the event. Chandolias and I still collaborate in disseminating the knowledge obtained from the project across multiple platforms.

The performance and outcomes of this project were disseminated in a number of ways. First, the actual performance and discussion were part of the Topological Media Lab's Re-Mediation Series on April 23 and 24, 2014 from 5-7pm at the Hexagram Blackbox, Concordia University (Figure 33). Second, Chandolias and I presented a paper about this project, entitled "Choreographing Computational Materiality: Interventions in Technologically Augmented Dance Performance", at ATINER: the 5th International Conference of Visual and Performing

Arts Conference in Athens, Greece on June 2, 2014. Third, Chandolias presented the work as part of Concordia University's Individualized Program Research Exposition on September 17, 2014. Finally, the process and various techniques are documented on a website, to show the process and performance, to share information, and to provide an opportunity for feedback.

Within *Orbital Resonance*, I elaborate on the significance of both technological development and movement-creation that speak to larger contexts in this field in the contemporary moment. The expertise and background of my collaborators will aid in this discussion. In what follows, I compare problematic situations that arose in the process of collaboration with more fruitful exchanges of relationality that occurred in performance. While trying to maintain an open space to dialogue, to create, and to maintain an interdisciplinary, horizontal mode of collaboration, there were many layers involved that I did not anticipate from institutional (the university, the graduate programs, and the affiliated research labs) to individual (inter/trans/multi disciplinary) factors that presented problems. I found it difficult to challenge and disrupt the dominant masculine hold on technology, encountering "boy's club" mentalities in institutional labs and among individuals. The process revealed the messiness of power dynamics and systematically imbedded protocols of gender roles, value, and disciplinary thought. A different and more productive entanglement of agency occurred in the performance, addressing the effects of the materiality of technology (sound, light, sensors, and more), of human bodies (performers and audience), and of space to create an affective and sensorial experience. Finally, I situate my research-creation project in conversation with other current artistic works that incorporate bodies-in-motion and technology, sharing and/or opposing similar aims.

In the year 2016, female machine tropes still repeat problematic and typical masculine appropriations of power and further complicate what is occurring within feminism at the present moment. In a mischaracterized post-feminist world, the production of gender and the production of technology are not mutually exclusive. Gender is still embedded in the design and use of technology. Despite this significance, it might appear that gender is no longer a factor. Networks and code, literally and metaphorically, dominate the way we develop, use, and discuss technology in the current socio-technical climate. To counteract the rapid influx of digital technologies, a shift is occurring again (similar to the early computational days) to more release-based contemporary techniques, somatic-based practices, yoga styles, and cross-fertilization of fitness routines to refocus attention to the body in a technologically-mediated world. These

techniques of movements have as focal points the need to increase face-to-face encounters to improve communities as real-life networks and to become conscious of breath and bodily movement in ever-prevalent compromising positions. Breathing is anatomically both a subconscious and conscious element, necessary for the continuation of life. In stretching the imagination, one could see code as an analogue to breath—the invisible entity that is necessary for the computer, giving life through instructions and creating the very fabric of software programs, webpages, and applications. As my practice is immersed in both the worlds of technology and dance, my objective of this chapter is to use my work as a case study to unpack how materiality, agency, and gendered subjectivity function as a method and a form of analysis of technologically augmented dance.

The Conceptual Framing of *Orbital Resonance*: The Moving Body within A Technical Universe

Within the black box where we performed, the mise-en-scène (Figure 34) consisted of two circular platform stages, a sound system, and three computers to use for the technical components of sound, the interactive lighting design, and the bodily sensor data in an open concept (no designated stage or audience space). We researched and designed one 6x4ft oval and one 4x4ft circular wooden platforms consisting of bendable plywood and MDF for the top surface for the best sonic result and light effect (Figure 35). The two platforms each contained 8 different light bulbs and DMX Controller alongside the transducer underneath the structure[xlv]. The sound system consisted of eight speakers spread evenly around the space, four speakers above on the grid, and two subwoofers on each side of the space. Additionally, we placed two transducers below the floor in the active space and under each platform to create a fully immersive sonic environment.

The name *Orbital Resonance* reflects the practical, conceptual, and aesthetic aims of the artistic work. In the field of celestial mechanics, "orbital resonance" describes the phenomenon whereby two or more orbiting bodies exert a natural frequency of momentum to remain synchronized based on their periods of revolution around a primary body. More often, though, orbital resonance results in an unstable interaction, where the larger body repels the smaller body beyond its orbit (Malhotra 1998, 37). To extend the metaphor of orbital resonance to

technologically augmented dance performance, my collaborators and I merged technical apparatuses with moving bodies in an immersive environment. In bringing these apparatuses into the 'orbit' of moving bodies, we produced a relationship where both stability and instability operate within all the interactive components.

The concept of "resonance" has three relevant definitions for this work. First, resonance is defined as the "reinforcement or prolongation of sound by reflection or by the synchronous vibration of a surrounding space or a neighboring object" (OED 2010). Second, resonance can refer to a more emotional and sympathetic response in a relationship to another being. Finally, resonance refers to "intensified sound heard during auscultation of the lungs or other parts of the body…capable of vibration" (Ibid.).

Following these definitions, and, in particular, the idea of resonance as that which involves aural intensification within a body, the aim of *Orbital Resonance* was to create sound from our moving bodies in space through breathing and vocalization, to intensify and spatialize these specific sounds in the whole environment, and to vibrate and transfer the sound to other objects —like wooden platform stages —to create a more visceral experience and emotional scenography among the performers and the audience. As media scholar Frances Dyson writes, atmospheres act as aural metaphors that evoke "affective states within social situations" where "mood, affect, emotion, and feeling" all matter in the "integration within, and subject to, a global system" (2009, 17). In thinking of atmospheres in this way, what we strove to convey was that this metaphor "returns us to breath, to the continuous and necessary exchange between subject and environment, a movement that forms a multiplicity existing within the space necessary for sound to sound, and for Being, in whatever form, to resonate" (Ibid.). Originating from the bodies of the performers, the sound creates a continuous feedback loop in multiple dimensions, ever expanding with others to create an orbital resonance.

Materiality of Technology in the Information Age: Dominance of Networks, Code, and Interfaces

Technologies in every generation present opportunities to reflect on our values and direction. (Turkle 2011, 19).

In the development of *Orbital Resonance*, crucial technological elements included the creation of a network to communicate between three computers and the technical devices of the xOSC microcontroller, sound system, and lights and of code using the JavaScript programming language to create interfaces linking the xOSC microcontroller and the spatial pattern of the speaker system to various outputs of media (sounds and lights). We needed to understand the materiality of technology to productively create an affectively dynamic and ethically conscious performance. This included researching the history of these devices, the people responsible for the design, the functionality, and the components that made up all these technical devices. In addressing these concerns, we were able to situate ourselves consciously and productively with our use of technology in the project and outwardly to the larger debates surrounding these devices.

Immersed in the Information Age, we are still dealing with the ramifications and rapid development of advancing technologies. In a highly networked and globalized world, humans are constantly connected to the Internet using the possibilities of the Wireless Application Protocol (WAP) for mobile phones and wireless local area networks for computer devices. Within the realms of the Internet (networking infrastructure) and the Web (system to access the Internet), networks, code, and interfaces impact our ability not only to communicate across computers, but also to create and access information. Still today, the ability to create and access these systems is stifled by gender, race, and class inequity. Of particular concern in this dissertation is gender.

After a hundred years in the popular imagination, the machine is still consistently and problematically mapped to the future developments of technologies like Artificial Intelligence onto the female figure (*Her 2013; Lucy* 2014); however, more hopeful situations are finally entering the script (*Teknolust* 2002). In one popular film released a year after my performance, Alex Garland's 2015 movie *Ex Machina* used the "concept of AI to not only explore what it meant to be human as such (which has been done before), but also what oppression does to *women,* specifically" (Cross 2015). In *Ex-Machina*, the female AI machine Ava is quite aware of her confinement and does not like it. Her misogynistic creator Nathan invents a freedom test—a Turing test— to be administered by a stranger, Caleb. Inevitably, Caleb falls in love with Ava and imagines saving her and running off happily ever after. Ava has another plan. She collaborates with another one of Nathan's creations, a voiceless, female Asian avatar Kyoko, to kill Nathan and entrap Caleb. Despite the repetitive narrative of men's control and domination

over technology, the story still gives a "sense of the nature of women's experience all the same, what it's like to be the "ball" in a patriarchal game between two men, and what that can do to a person. In addition, we are given a glimpse of relations between women" (Ibid.). This is not to say there were not other problems with the movie, including the problematic representations of minority women, the perspective of the story being told by the character of the male protagonist Caleb and not Ava, and the violent results to escape. Despite these quite crucial problems, this still was an improvement over the docile female automatons from the previous decade and details two technologies vastly present in our everyday interactions: interfaces and code.

To unpack these two crucial components of computational machinery, I turn to the field of media and communications for their expertise in this matter. Scholar and programmer Alexander Galloway argues that interfaces are not just objects (surfaces, screens) or boundary points, but also "autonomous zones of activity…[and] processes that effect a result of whatever kind" (2012, vii). In his critique of the unequal distribution of power globally, he views the interface as an allegorical device, departing from the mere physical attributes of screens and surfaces. An interface is a "technique of mediation" between "subject and world, between surface and source, and between critique and the objects of criticism" that helps us make sense of digital culture (54). A focus on the aesthetics of screens has distracted from more meaningful engagements and mediations on how interfaces produce effects by specific processes through interactions with something else, for example, the use of Facebook and other social media platforms in political revolutions.

Furthermore, in *Problematizing Global Knowledge*, Galloway is concerned about the implications of network systems and the invisibility of code. Both operations can lead to privileging surface over source (propriety vs. open[xlvi]/interfaces vs code) and to de-politicize algorithms. The former concern addresses the fact that even within open source movements, free access to code is still hidden (even if for practical reasons), thus producing a closed system of knowledge. The latter point addresses the lack of political critique of algorithms in current scholarship. This is a highly dangerous scenario where those that can create code and powerful algorithms hold the power to dictate the future. He fails to mention the huge gender disparity that also still exists. A political critique of code, algorithms, and interfaces needs to acknowledge gender as well.

In a discussion that addresses interfaces and codes with the added critique of gender, digital theorist Wendy Chun problematizes the interface as a metaphorical concept and as a physical component used in software design. Her concern is that contemplating computers as a purely visible media is incorrect and this effort effects complex power dynamics. Computers are "mediums of power" because "software's vapory materialization and its ghostly interfaces embody —conceptually, metaphorically, virtually—a way to navigate our increasingly complex world" (2011, 2). Interfaces are "mediators between the invisible and invisible," a way of mapping to navigate complex data structures that seem to produce empowered and "productive individuals" (8). When individuals become masters at the skills of coding, this can produce a "fantasy of the all-powerful programmer, a subject with magical powers to transform words into things" (9). In her analysis, she historicizes the trajectory of computing. She traces the origins back to its military and gendered labor practices, from the shift of direct programming to automation with software development.

Chun uses this historical approach to problematize the equation of women to software as something "emasculating…inspiring narratives of masculine expertise under siege," when women have always been placed lower in labor hierarchies of power, as programmers below male superiors (43). Another consequence in the actual practice of automation into direct or structured programming is the need to abstract data, which depends on making the code and information invisible and hard to find. Abstraction can either "empower the programmer or insist on his/her ignorance—the dream of a sovereign subject who knows and commands is constantly undone" (37). Software and its underlying source code are both abstractions that are "haunted… source[s] that rende[r] the machine—ghostly" (54). We might view access and use of software as an enabling condition, but are ultimately unprepared for the future it might prepare for us. Software gives us the ability to create through more user-friendly interfaces, but we are losing sight of the underlying code and the power dynamics embedded with it, which extend beyond a programmer's capabilities with code. The debate continues on how software and its underlying code are changing both the design and use of technology and our relation to it. Chun's inclusions of computation's military and gendered histories complicate the conventional narratives describing the power dynamics of human-computer interactions and software.

Pushing the problems surrounding code and gender toward a more direct focus on artistic practices, digital artist Claudia Herbst warns about code illiteracy, which can create a situation

where women (and men) "run the risk of being disabled in the spaces created by software" (2008, 33). Women are more visible in code-centric artistic practices where "dominant ways of knowing, applying, and conceptualizing technology are challenged" (86). When applying computing in the creation of artistic works, different strategies, representations, and formations can occur that might provide a road map for more innovative, interdisciplinary, and inclusive forms of knowledge to emerge. Herbst researched female artists in New Media Arts that use "code in the practice of subversion, activism, and creative collaboration, and apply computer programming in the creation of conceptually and aesthetically innovative works" (Ibid.). She found that the women she studied use computing in their creative practices to offset binary ways of thought, aiming to do so through demystifying code, weaving through multiple data flows to create non-linearity, abstracting narratives, and rendering body images and natural phenomena in the graphical design. As Australian feminist artist and activist Nancy Mauro-Flude states, "Our ability to create, plan and code our environment makes us responsible for what we create and for how we choose to live in that creation" (2008, 220). What these artists' works suggest is that creative coding can be a powerful activist platform to pressure the dominant masculinized technological landscape.

In the collaborative team of *Orbital Resonance,* we all came with different expertise and backgrounds that aided in counteracting conventional ways of designing, using, and applying technology in artistic performances. For Van Nort, through his middle to high school years, he had no interest in programming or in computers more generally, except for accessing information via the Internet. His passion was music. He manipulated sound sculpturally by technical mediation, which, at that time, meant using microphones to record environmental sounds and manipulating the recordings with a four-track tape recorder. In his Bachelor and Master degrees, he studied a dual program in mathematics and electrical engineering at the Liberal Arts College at the State University of New York Potsdam. During this time, he recalls, "I'[d] only ever taken one programming class [where] we just mostly wrote algorithms on paper which is hilarious" (personal communication 2016).

When he entered the MFA program for Electronic Art at Rensselaer Polytechnic Institute, van Nort learned about the software program Max/MSP. The program piqued his interest, as he states, in "the possibility of creating instruments— that's when I cared about programming" (Ibid.). He learned to program by necessity and in his desire to become proficient in Max/MSP to

create tools for art-driven projects, including a system based in Max/MSP entitled GREIS (Granular-Feedback Expanded Instrument System) that he developed from his MFA project.

In reflecting on his own position through this process, he fears that potential collaborators are interested in working with him only because he is a programmer or because they want to use the tools he has created; they are less interested in the ideas and exchanges between people that he deems more important. He reflects further on his desire for conversation:

> And so I think that I've gone in the other extreme of not even giving out tools for that reason. I actually would rather people read my paper and then come to me and say, hey those are ideas in there… I also make really messy code and I'm embarrassed by that…that's a secondary issue…Because I think I've got some tools that are useful… but also I think it's a good project for me as an individual and a human to break those apart into modulars that can reside in a lab in a way. (personal communication 2016).

Currently, he is in the process of working with Master students to break apart his code and create different modulars that can be accessed through the creation of his AMPD's DisPerSion Lab (DIStributed PERformance and Sensorial immersION Lab) at York University in Toronto.

For Chandolias, he received his first computer at the age of fourteen, but did not start to computer program until his third year in high school. He did not like programming at all, but received high grades for his work so he decided to pursue electrical engineering in university. He started to learn Java and C++ languages, but still had a hard time finding any passion in his work until he realized he could adapt the programming to different ideas outside of classroom exercises. Today, as a creative technologist who programs, he joins his love for dance and art with code. Aware of the political power of code, he does not have attachment to his ingenuity nor his position. He states: "So if a programmer says that he does everything from scratch I would say that's a lie… most or part of the functionalities will probably exist somewhere out there where you can grab, modify, utilize, and of course develop it more to achieve your goals" (personal communication 2015). He contributes to the open source mentality by sharing his code online.

He came to Concordia not as an engineer or programmer, but to take art-based courses that might merge his interests in both code and dance. He was an active member of the Topological Media Lab (TML) at Concordia, a research atelier-laboratory that applies media arts and techno-scientific practices to artistic research-creation, scientific investigations, and experimental philosophy. During his experiences, at times, it was hard to balance his role as both

artist and engineer. He felt that faculty members and TML lab members only saw him as the engineer and programmer: “I honestly did feel a little bit of pressure that if the technology fails that would be on me” (Ibid.). His work in artistic collaborations is more fulfilling, as he is able to shift his position fluidly between dancer and engineer, to step away from the computer, and to experiment and enact an array of ideas through performance.

Goldenberg’s position in relation to technology is more radical. Her aim is twofold: to disrupt and demystify the extreme power and ability of technology by creative practices and by activism. Growing up in the countryside of France, Goldenberg’s real encounter with technology occurred while she was completing a Master of Science in Information and Documentation with a Specialization in Multimedia. This led her to conduct research in India, where she began using mobile phone technology for the first time.

As a child, she always viewed herself as a technophobe. Although she began working with ‘basic’ technology (one computer, radio, microphone), she soon came to appreciate the aid of technology in activist movements. This led her to pursue a PhD in communication and sociology on "The Negotiation of Contributions in Public Wikis". A public wiki, at the most basic level, is a website that allows users to add, modify, or delete its content via a web browser; ideally, the public wiki promotes collaborative creation. In her research, however, she found that another narrative of exclusivity was created. She encountered a gender disparity in her field, realizing that out of the 150 people she interviewed, only one participant identified as transgender and one as female.

Now, inspired by free culture, she mostly explores the relationships between digital material, participative devices, public and collective action, accentuated with a trans-feminist technological perspective. She calls for a “re-embodiment” of technology, to constantly be “critical of the fascination of technology that tends to give more power,” by moving away from glossy, clean, and fully functional devices to more “dusty, rotten, and rusty technology” (personal communication 2015). At the current moment, she is prominent in feminist hacker scenes in Montréal, wherein she questions the centrality of the human body in its relations to technology through artistic practice. Feminist hacker spaces provide a safe, open environment to explore these questions.

Inspired by all my collaborators, I situate myself somewhere in the middle of all of them. I have limited understandings of Java language, mild abilities in HTML code, and proficiency in

working with microcontrollers and sensors, film and video, and sonic composition. I learned programming by shadowing Chandolias while he was working, and operated all the systems in *Orbital Resonance* with his and Van Nort's assistance. It was important to both Chandolias and I that we constantly switch positions between operator and performer during rehearsal periods. This demanded a certain level of proficiency on my part and patience on their end. This also meant that in the design of the various interfaces and patches in Max/MSP, I would aid Chandolias in the programming of these tools by researching open source code online and by emphasizing accessibility to non-programmers in the final design. Chandolias and I believe, contribute, and stress an openness to share ideas. One of the aims for our project was to demystify the development of code and movement in the process and to contribute to the open source mentality. Therefore, we created a website that included our research and our particular expertise on all the different elements in this project. A willingness to share and to collaborate has always been more important than economic compensation or career positions that might or might not follow creative works.

Our project muddled in between proprietary systems and open source software, infusing already designed hardware and software with our own code and interfaces. We used technology to aid in our goal of opening up the possibilities of agency in movement, sound, and light in relation to the performers and audience. In the process, we gave ourselves free reign to experiment with any technology, but only specific technologies seeped into the performance event that supported our aims.

In *Orbital Resonance*, we experimented with multiple ways of relationally mapping movement and sound. One option was to use camera tracking and motion analysis software to create an x,y position for a body in space, as well as to track and extract qualitative movement data information. We used the open source software VVVV to map the data from our movements to the light animations. The intention, especially for Chandolias, was for the lights to manifest into characters of their own. The holistic approach of scholar Vangelis Lympouridis and company members of Dubberly Design motivated Chandolias' design in terms of engineering, design, philosophy, and performance[xlvii]. Chandolias enabled a reciprocal relationship to take place between the interactor and the technology, which fused quite well with other methodologies provided by the other collaborators.

Another option was to use micro-controllers and sensors on the body to detect detailed micro-movements. With the xOSC wireless input/output board (that includes a built-in gyroscope, accelerometer, and magnetometer), we placed the sensor on different parts of our bodies (neck, waist, ankles, wrists, spine) while changing movement qualities such as acceleration, deceleration, orientation, and more. The designed patches created in Max/MSP extracted the data from the built-in xOSC sensors. The inputs of the sensor mapped to different sonic qualities as outputs (coming from our voice recordings of various textures and words).

There were multiple advantages to using the x-OSC device to detect micro-movements as inputs to map sound, lights, and any other computer-controlled data as outputs. The device was affordable and quite small, allowing integrated use with various body parts, costumes, and sets. By configuration through a web browser, the device is more stable then most micro-controllers available. Sebastian Madgwick[xlviii] who spearheads this project, has partnered with dance choreographers and other artists to expand the capabilities of this device. They support the open source ethos by providing source code and numerous project examples on their website. Although some of our experimentations proved quite fruitful, adding to our methods and conceptual aims within the larger research-creation work, the xOSC device was not part of the final showing.

Additionally, Max/MSP was chosen due to multiple collaborators' expertise with the program either because of individual artistic use or because of institutional lab support for the program to integrate real-time media instruments and techniques for various research directions. In the process, both Chandolias and Van Nort were willing to share and teach the capabilities of their patches and interfaces. Despite this productivity, the rehearsal process did reveal problematic aspects of power so often found in gendered practices of technology creating a hierarchy between the technologist versus the choreographer, body versus code.

In one particular moment in the rehearsal process, Nikos and I invited members from TML to assist us in our intended lighting design. TML focuses on technological development for the creation of spectacular visuals in real-time— an aspect of the usual technological disembodiment that we were aiming to disrupt. In exchange for rehearsal space, they offered to briefly teach and create a patch in the software program VVVV to use in our performance. Although these members were not part of our collaborative team, their energy created a break in

the flow of creation. Both Goldenberg and I felt a typical gendered relation occurring that caught us off guard (Figure 37). As she recalls,

> I really remember a difficult and also kind of clarity moment in the relation with the person who was working on the video…I had felt this division before…the lighting technique was very often taken by men and that gave them a kind of power on the general set up and that it really impacts the whole system...I had the feeling that…you were not taken seriously in some decisions that were really crucial and that it was linked to your confidence and your project. And then that he would not really engage with the collaborative process…[although he was not part of the project, he sill was] taking control or giving me orders… I remember reacting on that and being quite angry at some points. Reproducing a kind of star system where technician are the new stars and then you have a female fan (personal communications 2015).

Although we invited certain members for their expertise and specific tasks, the power dynamic still shifted into uncomfortable zones for all core members of the project. We were able to continue on with our intended design and to learn enough of the software to run the program ourselves, but it was a pivotal moment to reflect upon how stubborn and persistent gendered patterns recur that produce a culture of apathy, even with our constant awareness of power asymmetries at play.

Developing a Kinesthetic and Feminist Approach

Given the dominant modes of technology structured by code and interfaces, and a society "undergirded by racism and sexism and propelled by capitalism" in which "we are all shaped by the operation of invisible systems of power and privilege," there is urgency to feminist calls to action (Dicker and Piepmeier 2003, 18-19). Acknowledging the moves female programmers and artists are making within the tech industry and arts sector in computational fields, there persist many problematic relations in technologically augmented dance practice and in the broader context of associated technological domains. Female bodies, in particular, continue to be abstracted, objectified, and harassed —in labor practices, in research laboratories, and in online platforms[xlix].

More than twenty-five years after the publication of Haraway's seminal essay "A Cyborg Manifesto," is it possible to achieve a cyborgian agency beyond strict categorical divisions that maintain inequity and perpetuate abuse? The questions of relationality are still underway, but

addressing ideas around materiality, agency, and embodiment do help posit a different relationship between the (gendered) body and technology by going beyond fixed notions of gender altogether, to more nuanced discussions about materiality and agency, animal-human relationships, and haptic forms of interactions. They give space to address kinesthetic elements of touch through haptic creativity, of breath and proprioception through movement techniques, and of affect through empathy, care, and compassion in collaborations with human-non-human matter in knowledge-making practices.

In current feminist thought, the goal is to create and to live by an ethical framework that takes seriously the politics of accountability, responsibility, and care by intersectional research. My collaborator Anne Goldenberg still has difficulties with traditional ideals of feminism to aid in unpacking complex power structures for diverse groups of people. In her experience as an activist who straddles different worlds— from the academy to queer communities—the term and philosophy of feminism has not been accessible to everyone as a tool for creating solidarity within her classroom and in her life (personal communication 2015). She needed to adapt a larger anti-oppressive approach. In her work, she creates spaces to discuss and to challenge typical uses of technology, engaging in workshops and conferences, and producing art works and scholarly articles. She cultivates feminist hacker spaces, as a way to discuss issues of positionality, empowerment with technology, and safety with the aim to create a more caring and mindful relationship with technology and each other.

On the one hand, it seems difficult to surpass gender binaries when discussions within educational institutions, the tech industry, and the media center on the lack of female bodies: "where are all the female choreographers?" or "where are all the women in the tech industry?" On the other hand, there are different ways of approaching these questions, in which feminist, queer, and other marginalized others acknowledge that solutions still need to be found. For a more fruitful discussion[1], the question should be reframed, in accordance to what the group A Transnational Collective of Dance Scholars and Artists of Colour asks, "How do we create stage space and funding for racialised/queer/trans/differently-abled bodies and choreographers who occupy a spectrum of identities?" (2016, 1). They suggest, "What we truly need is a more complex platform and series of open discussions about which racialized, sexualized, gendered, classed bodies and which dance forms get funded. If the goal is to truly diversify who gets to dance, and/or whose dances get staged, then we also have to diversify what is being danced"

(2016, 2). Within the dance world, the majority of funding[li] is still allocated to mostly male-run or male choreographers' dance companies. In the tech industry[lii], where the demand of jobs increase everyday, there remains a significant lack of diversity in the workplace. Although my focus is on gendered subjectivity and the gendered social relations of technological use and development, there is an urgent need to address intersectional questions within the world of dance and technology, where there is a marked lack of participation by minorities, LGBTQ, and differently-abled performers and technologist. As an initial step, I do believe participating in the practice of dance and other body-based activities is productive to acknowledge one's own bodily position to create more compassionate relations among all human-non-human matter.

The participants of *Orbital Resonance* all came with different levels of experience with dance and body-based practices to give focus to kinesthetic elements in our creative process. For Van Nort, his earliest memories of dance were the ritualized social dances at school with members of the opposite sex where socially constructed norms of who could or could not dance determined the appropriate forms of exercise for boys and girls. Boys should play sports and girls dance. More broadly, his bodily practices of snowboarding and running contribute to his bodily awareness in addition to his love and practice of Pauline Oliveros' Deep Listening method (personal communication 2015). He encountered more formal aspects of dance with two artistic projects on which he collaborated. *Awakenings* (2003) was a "telematic work involving remote audience control, networked laptop performers, dancers, vocalists immersed in blended 3D scenery" and *[radical] Signs of Life* (2013) was a "multi-channel composition, improvisation, and interactive sound design, based on muscle sound for a large-scale biophysical dance piece" (Van Nort 2016). In his current research, he is interested in more kinetic activity to map unto other media material like sound and lights.

Chandolias grew up in the tradition of Greek folk dancing where more formalized training was still taboo for men to participate. Although he was a swimmer in high school, he eventually developed an interest in and obtained formal dance training in contemporary dance and ballet at The Greek National School of Dance in Thessaloniki, where classes were free for men. Frustrated by his prescribed roles in ballet, he pursued more diverse training in contemporary dance in Madrid, Spain for eight months. In Madrid, he gained exposure to different techniques of West African dance, Indonesian dance, musical theater, and Laban method. In his motivation to interactively combine dance and technology, he created his final

project about particular iconic dancers translated into visual computer graphics (personal communication 2015).

Goldenberg received training in classical ballet but her "skinny tomboy figure" and her perception that she was not "elegant" enough separated her from dance for a long time (personal communication 2015). Her re-entry into dance occurred when she entered into the "Dance your PhD"[liii] competition sponsored by the American Association for the Advancement of Science and their publication *Science*. Her work, comprised all non-dancers (three male computer 'geeks' and five women) who came together to create movement based on her PhD dissertation, which had won first prize under the category of social science. Both her theoretical and performance work led her to observe the poetics of collective contributions through various forms – multimedia, social sculpture, performance and installation. Receiving additional training in the Feldenkrais technique shifted her relation to her body and merged into her thinking about dance.

She combined these interests into her performance work *Diaphanous Algorithms* (2012), a collaboration linking herself, two dancers and one female musician to computer coding and looping processes through voice, musical instruments, and movement to "define the relationships between humans and operating systems. Code, as language, connivance, encryption device, or dissemination matter, crosses our everyday and our environments oftentimes in stealthy ways. What is the source of code?" (2012). Through a naïve approach to technology, Goldenberg encouraged a more playful, tactful, and improvisational approach to foster creative material, especially considering that the dancers, at first, were quite negative and distant about working with computational processes. The challenge was to create a poetic approach to text and to code, translation the instructions received into movement, sound, and imagery. She continues to explore body-based practices that emphasize awareness of her and others' bodies in a more explorative and improvisatory manner, emphasizing feelings, sensitivity, and softness. In creating safe-spaces, she wants to depart and challenge stifling conditions and normative behaviors that occur in the world of dance and technology.

My experience in the dance world has also been difficult. With professional training in classical ballet and contemporary dance, I still struggle with the position of the dancer and with normative expectations of body image. My artistic practice emphasizes collaborations, whether in creating performances or more traditional films. Although not intentional, I have mostly worked with female collaborators. During my studies in Montreal, I began to pursue more

collaborative exchanges with fellow participants through the research center Studio XX and through the PhD Humanities program. In one such encounter in 2012, I met Anne Goldenberg through my interest in her work *Diaphanous Algorithm*. Because of our similar interests, we became friends and collaborated on a work entitled *Black Magic | White Magic* presented as part of Laboratoire Phenomena at Casa del popolo in May 2013. The work was an exploration of movement, sound, and technical devices (laptops, projectors, cords, and speakers) among three female performers. The intention was to cast a poetic, ironical and humorous glance at daily gestures, rituals, power, and fragility that are at stake in complex relationships between humans and personal computers. During my PhD, I have been distanced from the dance world, but have kept a bodily-practice of numerous different movement techniques to maintain connection to my body through breath and to develop strength and flexibility. Through other practices of movement, I continually try to redefine what dance is. I have engaged in various workshops and residencies emphasizing collaborative methods to develop technologically augmented dance performances. In my attempt to foster more productive relations between technology and dance, I have tried to adapt STS not only as a scholarly method, but also in the movement creation, the act of the dance.

Collaboration: From the Process to the Performance

In the process and performance event of *Orbital Resonance*, collaboration was key to accomplish our goals of addressing agency, materiality, and gendered subjectivity productively. To unravel the complexities of collaborations, Haraway proposes the following pragmatic solutions:

> making sure experiments are well planned and executed; taking the time to practice care among and for all people and organisms in the lab and in the worlds reached by that lab, even if results come more slowly or cost more or careers aren't as smooth; and practicing the civic skills of political engagement and cultural presence in these sort of issues, including the skills of responding, not reacting, to the discourse of those who do not grant the goodness or necessity of one's scientific practices (2008, 82).

All participants felt and contributed to these different dynamics to varying degrees. Chandolias was particularly effective and knowledgeable in developing and programming the technical devices in-use and I brought more feminist, body-based practices to the process. Despite our

distinct expertise, we were involved in the formation and design of all the elements together (aka we spent a lot of time together inside and outside the studio and a friendship developed). In our collaboration, the focus to share skills amongst each other was crucial to develop a responsive and caring engagement to experiment artistically.

In evaluating the particularities of collaborative endeavors, interactive media artists OpenEndedGroup state that there is a difference between collaborators and other types of participation (either as contributors, contractors, curators, and constituents). For them, collaborators work together to create an "equal basis in the overall conception, construction, and revision of the project," to bear all responsibility, and to understand their distinctions with other participants (2013, 2). From the start, we wanted an "equal basis" among all four of us as participants and performers and between the different materials in play, meaning all agencies should have equal weight and say. I believe in the final performance event, our intended goal was realized, but the process varied due to multiple factors of timing, expectations, motivations, and different subjectivities.

Van Nort and Goldenberg's expectations were not met as collaborators, but as contributors, where they excelled in "contributing their special expertise to [our] project" (Ibid.). From the beginning, I believe there was a common goal to be equal collaborators for the project, but due to time restraints and miscommunication between all parties on the expectation of their roles, the process was an on-going negotiation of productivity, creativity, and disciplinary modes of knowledge. The most productive use of time was when fluidity occurred between the behaviors and experiences of technology, sound, and movement.

In practice, collaborators either contributed to technological design or offered dance-making knowledge. For example, Chandolias and I divided our time between movement studies and technological development. Dance is a "different kind of knowledge from what we generally accept as rational, technical, or discursive knowledge. The scene for this different kind of knowledge is set in the moving body" (Brandstetter 2007, 40). Participation varied between whom explored more of the technology compared to movement creation, in which my motivation was to value artistic creation of both technology and dance together, giving space and time to apply the benefits of kinesthetic knowledge to the application of technology. Goldenberg, in particular, was concerned about this split in the division of creativity and responsibilities. As she recalls, "I felt that some people in the group were not completely

comfortable to play with us in advance," due, possibly, to stress, to other priorities, or to their perception that they did not need to practice with us (personal communication 2015). She continues, "I was a bit sad to recognize some pressure that I find typical from academia which is to engage yourself quickly in a way that would gain recognition. What I thought we were doing was more intimate than looking for recognition and I really value that and to me, it is visible in the output anyway, not an immediate process" (Ibid.). Mirroring her concerns, at times, I felt that we spent less time and energy working with dance-knowledge in comparison to the time and energy devoted to technological development of the various apparatuses. Reminiscent to the *9 Evenings* event, the rehearsal periods shifted focus to technical prowess and stability. When a merge did occur in applying kinesthetic knowledge to technological design and use, new ideas did form, but more time and space were needed to fully develop these interactions and all participants needed to be involved.

Despite the uneven power dynamics in the creation process, the performance event evoked an intra-active entanglement of agencies. The performance event achieved our aims of disrupting gender stereotypes through a nonhierarchical mode of practice. In most cases of dance and technology works (or even most dance performance events) since *9 Evenings,* there is a clear divide of stereotypical gender roles. The same configuration still prevails. Men are typically behind the computers, and women are usually the dance choreographers and/or performers. Shown through the history of this field in previous chapters, a significant number of works reveal this dynamic, and recent studies, particularly in computer science, reveal gender disparities within multiple practices related to computer programming, experimental music, and more. These socially inscribed gender roles are particularly stubborn and difficult to fracture.

It is not surprising then, that the two males did the majority of the computer programming and sound in this work. Their activities, however, were influenced by my constant interactions and feminist sensibilities in the development, use, and display of these technologies. In addition, Goldenberg's own persuasive feminist techno-sensitivities added reflexivity toward how technology was used and for what purpose. There were two main goals for all participants: 1) to actively use and initiate all practices from the body; and 2) to step away from the computer screen. Our performance event invoked different ways of approaching the typical set-up of a performance event, the different agencies in action, and the development of play within the environment for both performers and audience members. As Chandolias remarks, "in the

performance event, all of us had a little bit of ourselves in it," including the technology and various mediums of sound and light (personal communication 2015). All of the technology was set to automate with the use of programmed time-based operations. No human agent was situated behind the technology, but active alongside the other technical components and the audience, to create the content through improvisation in the performance space.

Performance scholars Sita Popat and Scott Palmer also reflect on a similar situation in their collaboration between KMA Creative Technology of software and graphic programmers with dance students at University of Leeds entitled Projecting Performance. For them, when dancers and operators of the technology were able to "improvise freely within both the digital domain and the physical stage space," major breakthroughs in their research occurred (2009, 424). All the participants took on the role of performer.

This approach is in contrast to standards in "industry practice" where "it is common for technical operation to occur away from the place of performance, removed physically from the stage space itself and distanced by glass screens and layers of technology. This practice has been highly criticized (Hunt 2001; White 1999; 2010), since the operator often experiences little engagement with the creative act of performance and may simply be pushing buttons" (425). In contrast, we wanted an event that disrupted stereotypical roles of gender and vision as the master sense to create an experience of mutual exchange between all elements (audience, technology, senses, architecture, performers, and more). We removed the possibility of human operators (of either gender) to eliminate the power dynamics of control that can occur when additional live-performing bodies and audience members are in play. All of our technical apparatuses were visible on stage, not hidden away by curtains or pushed to the side of the room. The audience freely moved around the space, noting the automated programming occurring on the computer to the movement of bodies, sounds, and lights in the adjacent space. Our focus to open up the possibilities of agency through an affective and material discursive practice aided in the disruption of problematic binaries and typical classifications of gender, of dance, and of technology.

The Performance of Productive Modes of Agency, Materiality, and Gendered Subjectivity in *Orbital Resonance*

During the process and performance event, *Orbital Resonance* is one type of intervention that aimed at creating a shared, mutual exchange of control, an "open site for the development of an embodied and flexible subjectivity" and an atmosphere of entangled agencies in action (Parker-Starbuck 2011, 161). In aesthetic, imaginative, and representational spaces in the creative processes and performances, I use notions of embodiment and agency to analyze the functionality and importance of both the materiality of the body and of technology. Dance performance "grants its participants special license to imagine themselves and the world otherwise" but also "to bring those imaginings to life" by subjecting their work to a live audience (Marra and Schanke 2005, 11). The performance was a co-creation, an interaction, and an invitation to play between all actants in an active, open space.

In order to apply methods of STS notions of agency, materiality, and gendered subjectivity to creation, a focus on the kinesthetic capacities of human bodies entanglement with the application of technology was crucial to responsibly and ethically account for the multiple perspectives of the "mover, observer, and machine" (Locke and Roberston 2013, 1). This involved experimenting and adapting particular strategies of haptic visuality, haptic creativity, play, improvisation, and displacement to question the inherent source of human agency and to re-imagine a more productive intra-action of agents. Although we cannot "escape our bodies," as anthropologist Thomas Csordas states, as "embodiment is our fundamental existential condition…defined by perceptual experience and mode of presence and engagement in the world" (2011, 138). From my own first-person experience and branching out to my collaborators, an attuned focus to embodied actions was imperative. We experimented with a range of body-based practices to assess the best options that worked well with integrating technology.

Over two separate month-long residencies in the Hexagram Blackbox, a succession of workshops and rehearsals using warm-up movement exercises and short studies, improvisation, automatic writing, digital video feedback and photography were all used in our reflective practice[liv]- "a coherent framework to develop our methods and tools for deepening and documenting our emerging understandings of practice" (Haseman 2007, 153). We dove into

multiple exercises and improvisations (Figure 39) informed by a cross-fertilization of different kinesthetic methodologies: Pauline Oliveros' Deep Listening, Skinner Release Technique, Viewpoints, Contemporary Dance, Yoga, and Open Source Forms (OSF).

During the first month of our residency, the following questions fueled our inquiry: What would happen if we eliminated the visual feedback of our bodies and light in the space? Is it still a dance if there is no visual feedback? How do we retain, process, and disseminate information from our other senses? What does this feel like and how can we replicate this experience for the audience? In order to approach these questions, we created different movement activities to address visual dominance that occurs in dance.

Historically rooted and privileged during the Age of Enlightenment, "vision has influenced the definitions of knowledge, validity and experience" (Schiphorst 2009, 225). Vision has been categorized as the most "cerebral of the senses" upholding the Cartesian dyad of mind over body. Feminist scholars have highly criticized the sense of vision due to its powerful association with the mind and "distanciation from the body," as well as its' power to objectify and control the seen object (Marks 2000, 133). In our research and in the performance, we wanted to destabilize the hierarchy of senses, particularly ocularcentrism.

During workshops, Chandolias, Goldenberg, and I would improvise blindfolded in multiple short dance studies as a starting point in our path to destabilize vision. At certain times during the exercises, spatial areas were mapped to pre-recorded sounds of our voices, activated by the size of our movements (Figure 36). Our attention focused immediately inwards, where we had to experiment anew with how to communicate by movement and sound to create interactions amongst each other. Our kinesthetic awareness of touch and of hearing became focal points. We developed an acute awareness of our bodies contact with air, with each other, and with the various surfaces in the room. We could feel the vibrations in our body while talking. The effect of hearing us speak out loud and triggering additional sounds in the activated space fluctuated our emotions. At moments, we felt alarmed and shocked or comforted and relaxed, depending on our relationship between the sonic material, our bodies, and our location in space.

A certain level of vulnerability released out of our bodies, a necessity to maintain a sense of openness for playful, creative, and supportive modes of relating in movement. As Haraway states, "once one has been in touch, obligations and possibilities for response change" (2008, 97). In the process of creation, touch and play were pivotal to care for each other as collaborators and

for the relations with other materials like sound and lights. Play only occurs "among those willing to risk letting go of the literal" (Ibid.). The platform of creation in dance and through performances, as both spaces that give space to play beyond literal and rational thoughts, allows more positive imaginings of embodied actions. This illuminating experience was something we wanted to convey to the audience.

To replicate this deeply embodied experience to the audience, we had an idea to blindfold them, but due to ethical and safety concerns regarding the space, we decided to abandon that idea. In order to accomplish this, I was motivated by the feminist film scholar Laura Mark's strategy of haptic visuality. This provided a safe method to apply these ideas in practice by experimenting with different light stages to replicate and represent as best as possible the "blindfold" approach to the audience. Haptic visuality is an embodied sense of looking where one tends to "move over the surface of its objects rather than to plunge into illusionistic depth….more inclined to move than to focus, more inclined to graze than to gaze," where one might have to resort to other senses beyond vision to interpret and relate to the image and/or performance in view (Marks 2000, 162). We embodied these ideas in the performance event.

We began in pitch black where audience members commented on feeling disoriented, afraid to bump into something. As one female audience member recalled, "I felt disoriented because of the darkness and unfamiliarity with the space…I remember the spotlights gradually illuminated the space to notify to me an event was happening and I heard the sound of breath which made me away of my own fleshy, breathing body" (personal communication 2014). There was no possibility to plunge into the dominant sense of vision. The attention focused on our breath, creating an ominous feeling for some of the audience. The performance shifted between different light states, through various feedback we received on wanting to see what the performers were doing (an aspect to research further), but we were successful in dismantling, if only for a little bit, the dependency on vision for the audience and particularly for us (Figure 38).

Through the blindfold improvisation, breath became a pivotal instigator for both sonic exploration and movement development. "Breath is a fundamental embodied process connected to action, expression and internal state and often acts as an unconscious communication between performers" (Corness 2011, 3). A focus on breath allowed for a fluid improvisation between all four performers. The progression of our breathing led to more playful interpretations of vocal sounds, for example, clicking, whistling, slurping, and more. The input of the sounds of our

breath and vocal sounds by wireless microphones were progressively amplified, filtered and spatialized through the surrounding speakers from below, around, and above in the space. The distinction between who was making what sound and where that sound was located no longer existed, for "sound has no loyalty to the object being represented" (Dyson 2009, 141).

Through somatic practices—particularly Deep Listening— that enable embodied acts and improvisational techniques in dance, *Orbital Resonance* addresses the implications of gendered bodies in the space and agencies of all materials in play. Van Nort reflects on his experiences with Deep Listening, explaining how this practice can "facilitate connection" and allow for "introspection", where, in order to be "in touch with our neighbor we need to be in touch with ourselves and our surroundings" (Oliveros 2005, 72). This practice brings "people closer to the fabric that binds them through a common experience" of sound (Ibid.).

Discussing a similar set of approaches in practice, theater scholars Liesbeth Groot Nibbelink and Sigrid Merx (2010) analyze artist Ivana Müller's (2006) *While we were holding it together* as an *intermedial* performance. They define *intermedial* performance as a work that uses different elements that "play with or even explicitly deconstruct perceptual expectations and produces sensations ranging from subtle experiences of surprise or confusion, to more uncanny experiences of dislocation, displacement or alienation" (2010, 219). In Müller's work, a strategy of displacement occurs where the sound of one dancer's voice is "displaced" and "transported" to another dancer where eventually the voices and bodies do not match up through digital technologies of wireless microphones and amplifying equipment. As a result, "bodies become 'other', disturbing notions of gender, subjectivity, corporeality, and presence. The strategy of displacement contributes to the spectator's awareness both of her own haptic experience and of her attempt to assign meaning to what she sees" (222-223). In displacing notions of subjectivity, the performers and audience all become aware of their own bodies and intentionality.

In our work, as one audience member recalled, "I couldn't differentiate between the voices or genders of who was making the sound, I would look at the mouths and still couldn't tell where the sound was coming from" (personal communication 2014). In these type of performances, the strategy of displacement by the use of technology to separate the source from the material, makes the audience "aware of how we, by looking at bodies, classify people at first sight, displacing them in fact, as such-and-so a human being. Revealing the material body and the discursive body simultaneously, this aesthetic research into media and perception surpasses

its own boundaries and truly functions as a theoretical object" (Nibbelink and Merx 2010, 225-226).

A voice "ushers forth from a body," but in the process of displacement and digital intervention, also "transforms one's body" (Myers and Dumit 2011, 249). Anthropologists Myers and Dumit label this haptic creativity, a practice that "sweeps up bodies and imaginations into a new type of knowledge" (253). In this sense, *Orbital Resonance* also functions as a type of *haptic creative* practice, formulated from the body and imaginative use of technology outwardly expressed to the audience. The displacement of our body through the strategies of haptic visuality and separation of sonic material produced a new type of kinesthetic knowledge.

Additionally, the use of improvisation played a key role in subverting "traditional power relationships between choreographers and performers and challeng[ing] the notion of authorship" (Lycouris 2009, 349). In improvisation, patterns and relationships can be both stable and unstable, challenging the intuition, awareness, and actions of performers involved. But through this process, the artists allow "for their technologies and techniques to lead them beyond finite results in a process of motion," resulting in "democratic potential" and a "wilderness of complexity" (Bucksbarg and Carter 2012, 7-11). In the performance event, improvisation allowed more fruitful non-hierarchal exchange between all the elements (performers, technology, audience, and space) to create both an unstable and stable conceptual orbital resonance.

In the performance event, our bodies took on multiple subjectivities through strategies of somatic practices, displacement, and improvisation that sought to subvert stereotypical and disempowered notions of gender. Additionally, as both performers and collaborative operators of the technology in play, we partook in the development of technology, understanding the implications of all technical apparatuses and agencies in the same space as well. This is not to say that during the process all agents were equal and active. Different bodies (institutional to individual) took varying degrees of control at distinct times, but the performance event did allow for this play between bodies, technology, and spatial environment.

Our objective in the performance event was to create an intra-action of multiple agents, where through the movement of these specific objects (human and technological) an "ongoing reconfiguring of both the real and the possible" would be created (Barad 2007, 177). With a renewed examination of agency and performativity, Barad's concept of agential realism delineates agency as something "cut loose from its traditional humanist orbit" as an 'act', a

performance per se, "through the dynamics of intra-activity", not an attribute that "someone or something has" (178). The performers had agency in their creation of sounds, movements, and choreography of the various technical components. In a reciprocal act, though, the audience and technological devices dramatically altered the experience and environment, shifting the behaviors, response, and actions of all human and technical phenomena. Technology also acted "upon the space, altering the architectural and energetic nature … and these changes in the physical space cause an alteration of behaviour by those that inhabit" the performance event (Paine 2002, 11). Through strategies of haptic visuality, displacement, and improvisation, *Orbital Resonance* creatively and productively imagined bodies and selves otherwise, where all agents co-mingled and co-created in the act of performing.

In Conversation

The trajectory of this work follows contemporary practices of interactive media installations, participatory installations, augmented reality performance, and technologically augmented dance performance. These are all names for similar types of works, not to mention the other common descriptors, listed by theater scholar David Z. Saltz, of "multimedia performance, intermedial performance, performance and technology, cyborg theatre, digital performance, virtual theatre, and new media dramaturgy….[For] scholars and practitioners have yet to settle on a name to describe performances that incorporate digital media" based on the "subtle, yet important differences"[lv] in how people define their place in the field.

From more contemporary dance works in Amelie Hinrichsen's *aus(sen)atmen* (2014), to interactive installations in Rafael Lozano-Hemmer's *Last Breath* (2012) and *Pulse Room* (2006), to visually dominating interactive performance works in Adrien M/ Claire B's *Hakanaï* (2013), the technological and performative aspects of body-based physiological data have been a clear focal point in recent times. To consider the thematic conceptions and notions of femininity in my work, I refer to Montreal-based *Isabelle Choinière's Flesh Waves* (2013).

In *Flesh Waves*, Choinière created and directed an augmented reality performance with lighting designer Audrey-Anne Bouchard and sound designer Ricardo Dal Farra. The work was described as an exploration between relationships that arise from bodies-in-motion, sound spatializations in real-time and lighting to "reach unpredictable sensory experiences and

unknown territories" (*Choinière 2014)*. With similar aims to my project, the work varied in the way it was executed and discussed. The performance included five nude female dancers, "forming a three-dimensional human sculpture, a collective body" in which their breaths, chants, and bodies carry each other into a "continuous wave" (Ibid.). The performers generated the sounds in real-time that were manipulated and spatialized by two male sound operators (Kevin McDonald and Karim Lakhdar) visibly located outside of the active space at the same time.

When I viewed the performance, the audience was invited to move around, although chairs were laid out in a circular pattern around the dancing bodies (in discussions afterwards it was stated that in fact the audience should not interfere in the space of the dancers - perhaps due to the sensitive nature of nudity). There were six loudspeakers surrounding the audience at height level. The two male sound designers were in the dark outside of the active space alongside the female lighting designer. Men controlled the technical interfaces for the sound spatialization, while female bodies produced and performed the thematic content. The mise-en-scene replicated the problematic set-up of operators versus performers, creating power asymmetries between the technologists versus the performers.

In an interview conducted by Marlon Barrios Solano, Choinière explained her process and intentions around the use of the technology and of the female bodies. She commented that she used technology "as a new environment, a new physicality…as a vibration of the sound that will go through your body, through the body of the public… that will destabilize you, so technology is an agent that will destabilize your sense and your perception" *(2014)*. The displacement of sound from the collective body was destabilizing, but the stark nudity and intimate closeness with these bodies was too powerful of an image in comparison to the other elements. The visual stimuli of the female bodies combined with the technologist controlling the placement and appearance of their vocal noises overtook the overall aim of creating different accounts of agency. The representation of the collective body composed of all female bodies revealed a very particular notion of subjectivity.

Choinière's described the collective body as a form to reflect "the complexity of our organization, our social organization our social relation, to get out of the causal link of technology" (Ibid.). But our social organization and/or our social relations are so entwined and prescribed in gender and sex that this collective body was not collective of all bodies. The interviewer Solano specifically asked her why she chose to use all women, to which she

responded jokingly "because I'm aging", and continued to explain that her interest lies in "one sensuality, the body sensuality, and also a kind of eroticism, … exploring the state of taking a risk, personal… and how this state of fragility that you need to reach to get in this open state, other kind of embodiment, that is extremely risky because you open yourself and the other can come… a feminine kind of energy" (2014).

Solano continued to push in asking what would change if it were all men performing or a male director or a mixed bag of performers in which she only responded by stating, "the mix is tricky…becoming orgiastic" (Ibid.). Choinière's response is revealing about the anxiety and fear of female artists and women in general of aging and of beauty. But this was not her risk or her body on display, even though it did not necessarily need to be. The problem lies in that creating representations of bodies, of technology, and more, in general, literally falls upon female bodies with no acknowledgement of the repercussions of such acts. The work would be dramatically altered if there were all male performers or if it were directed by a man, which points out again that gender does make a difference as subjectivity has to be acknowledged within the overall play of agencies.

Conclusion

Orbital Resonance was an intervention in a field of exploration that remains vastly open. This Research-Creation project was a platform to explore what might happen when diverse gender expressions and several academic disciplines of thought join together to create new understandings about agency, materiality, and subjectivity through the creative process and the performance event. The work also demonstrates how different modes of working occur that alter the dynamics between all participants in the various stages of the work. In the creation process, there were difficult negotiations between disciplines and genders, a constant interplay of power, values, and techniques. Due to the large-scale atmosphere of this project, everybody from the various research labs (Hexagram and TML), multitude of academic disciplines, black box technicians, and the four performers did not have the same goals or intentions. Agency and power played out in an array of different directions, in which maintaining a non-hierarchal stance was hard to accomplish. Institutional to individual behaviors, all socially constructed, were particularly stubborn at moments where the want to deconstruct and destabilize all these factors

in and through a single event went beyond the scope of this project. As shown from the two previous case studies (*9 Evenings* and *loopdiver)* and my work, roles and responsibilities fluctuate constantly in the creative process.

In contrast, the performance event can provide a moment of clarity, balance, and respite from what happened in the process. Moreover, the performance experience provides a moment to imagine and to believe otherwise, away from logical and rational ways of thinking. In the performance (Figure 40), our bodies took on multiple subjectivities through strategies of displacement, somatic practices, and improvisation that subverted stereotypical and disempowered notions of gender. Additionally, all participants of human performers, technology, architecture, and audience collectively came together to muddle the boundaries of troubled dichotomies and to manifest a material-discursive practice that reconfigures agency in the act of performing.

Finale

"The histories that bring us to feminism are often the histories that leave us fragile. It might be an experience of violence. It might be the gradual realisation that gender requires giving up possibilities you did not know you had; it might be a sense of being wronged or of something being wrong. We often have a sense of things before we can make sense of things… Feminism: how we make sense of things. But there can be sadness in these moments, too; you might feel all the more shattered, all the more fragile, the more you realise just how much there is to come up against."
(Ahmed 2015)

In tackling the complex dynamics that occur in collaborative artistic practice and performance between agency, materiality, and gendered subjectivity, I weave together theories from dance and performance, sociology, technoscience, computer science, electroacoustic studies, and Science and Technology Studies. In a case-study approach through four artistic works (two historical and two contemporary), I have sought to uncover both possibilities and problematics through the perspective of feminism in technologically augmented dance practices. My methods are historical, biographical, conceptual, ethnographic, and phenomenological through my situated knowledge perspective to examine technologically mediated and embodied practices that, in turn, counteract traditional ideas around identity and relationality.

Writing about Dance

In a seminar entitled "Exits and Endings: A Conversation on Dance, Performance, and Writing" at Concordia University in 2015, performance studies theorist Peggy Phelan stated, "When writing about dance, you need courage because you are always writing about yourself." Writing this dissertation is indeed a reflection upon my identity and beliefs. This was not an easy task to accomplish and proved quite challenging to uphold feminist aims that were constantly shifting throughout the generations to the pragmatic conditions of everyday life. Throughout this process, I felt burdened by the hardships and struggles these artists and I faced within the larger contexts of both dance and technology. It seems odd that in writing about dance, there is a necessity to bring back kinesthetic knowledge into a field that is created by the body. The

accounts of the moving body have been written out of technoscience and new media arts as well. My investigation was my way of making sense of things.

In the present moment that is currently undergoing an influx of backlash against marginalized others, art historian and feminist Dr. Jennifer Way raises the additional concern that we need to "redress a lack of knowledge about contemporary women's individual and collective uses of technology in their work as artists, designers, educators, historians, art writers, museum and gallery staff, and arts administrators" (2012, 1). Talking to women about technology is a high importance feminist project, as she states, "we lack not only existing but also new work on women or gender, art and technology in general and concerning veritably any subtopic that comes to mind" (2012, 2).

In my own work, I hope to contribute to feminist objectives that "serve as a corrective for androcentric notions and assumptions about what is "normal" by establishing or contributing to a new knowledge base for understanding women's lives and the gendered elements of the broader social world" (Geiger 1990, 170). My project's importance is to highlight female dancers and choreographers enmeshed within the world of dance and technology, but also to acknowledge the multiple collaborators, objects, technical apparatuses, and space that also contribute beneficial knowledge to the creation of such artistic works.

In tackling issues of agency, materiality, and gendered subjectivity from a historical to contemporary outlook, I have leaned on the wise words of Karen Barad stating, "the "acknowledgement of 'nonhuman agency' does not lessen human accountability, on the contrary, it means that accountability requires that much more attentiveness to existing power asymmetries" (2007, 219). This attention to "existing power asymmetries" is essential when analyzing technologically augmented performance works as well, to examine what is occurring between the technical apparatus and the gendered body in the process and performance.

The triangulation among technologies, power, and bodies has continually been increasing in our culturally, socially, politically and economically entangled world. As Science and Technology Studies feminist Donna Haraway boldly states, "the relation between organism and machine has been a border war1. The stakes in the border war have been the territories of production, reproduction, and imagination" (1991, 150). A radical change, though, has occurred in the twentieth century because of the ever-increasing speed in technical transformation and production. This has led not only to a "hegemonic consensus in modernity," but also to "getting

out of sync with the speed of the development of other areas of life: social, cultural, spiritual, legal, and so on" (Kember and Zylinska 2012, 16). A principal aim for feminist theorists is to challenge the culture/nature, subject/object, mind/body dualisms that "ha[ve] proved remarkably resilient" and to provide methodologies to disentangle such divides (Haraway 2008, 71). In my research, I investigated both theoretical and practical approaches towards strategies to re-map gender through discussing the challenges of agency, the spaces of intra-actions, and the continuing constraints in the area of technologically augmented dance performance. The importance of these histories is to give voice and recognition to kinesthetic knowledge from the perspective of female artists through modern and post-modern epistemic regimes.

Starting from the late 1800s, Loïe Fuller and her counterparts of Valentine de Saint Point and Giannina Censi represent the emergence of the female machine stemming from electrical technical innovations. In uncovering spaces of intra-actions, Fuller's performances embodied productive modes of agency, creating a seamless unity of movement, materials, and sensorial environments. This did not come without battles though. In an era where women still struggled for the right to vote, it was difficult for Fuller to obtain recognition for her technical innovations and copyright protection for her dance works. Her works are a testament to how to create an intra-active performance, celebrating the liberatory aspects of the figure of the cyborg. All three female artists contributed to a refashioning of embodiment away from essentialized gender binaries and technological determinism. They changed preconceived notions of what it meant to be a woman, shifting dynamics of power on the stage and in everyday life that accounted for different agencies, materials, and subjectivities.

Further along in the post-World War II, Cold War era, the socio-technical mode of production changes where the advancement of military-driven thinking took precedence, spawning counter-attack movements to destabilize the structures in power. From the 1940s to the 1970s, the era was ripe for transformations as established and problematic categorical distinctions were not yet codified or prescribed. In the climate surrounding women and technology in the workplace, a shift occurred after the war in which opportunities that presented themselves prior were rapidly dwindling as a boy's club mentality around new forms of computer technology grew stronger and more exclusive. There was also a parallel between what occurred in the division of labor of artists versus technicians within the *9 Evenings* event that mirrored this gendered division of labor. But all was not lost. With some major successes within

social movements with an importance given to the body, particularly within second-wave feminism, and new methodologies created from modern to post-modern dance, the body-machine paradigm shifted into demystifying and acknowledging the process to reveal the effort of human labor amongst the innovative, yet unknown capabilities of computational technology.

In the context of early computational technology, the *9 Evenings* event took place where Yvonne Rainer's *Carriage Discreteness* was a successful intervention into queering normative structures in dance, technology, and gender. Despite difficulties within the creative process where stereotypical gendered divisions of labor persisted and technological development took priority, the performance event was an assemblage where all agents were decentralized in the act of movement.

Through techniques developed within the Judson Dance Theater, Rainer used dance to counteract productivity, innovation, and capitalist mentalities and ideologies often found in the realm of technology. Her focus on task-based, accessible movement versus codified techniques with a diverse cast of performers aimed at de-objectifying the body outside the realms of traditional theater spaces and contributed to her success in breaking down hierarchical power structures involved in the relationships between technological apparatuses, everyday objects, and human bodies. Simultaneously, *9 Evenings* projects by Hay and Childs also reveal similar strategies in their ability to disrupt dominant ways of creating and displaying dance, technology, and gender. This event marked a clear shift of gendered roles in which moves to disrupt these notions are still happening.

Later on, the affects and consequences of the Cold War shifted the relations between technology, gender, and dancing bodies in a twofold manner. With the proliferation of digital technologies, a utopic celebration of technology occurred that fostered new understandings of relationality and subjectivity, rallied by Third-wave feminism and more nuanced groups of cyberfeminist to disrupt unproductive and hierarchical modes of power. On the flip side, the ideas of control and command again took dominance within the socio-economic and technical scene, imposing ideas of surveillance, loss of individual rights, and more restrictive actions against bodies. The possibilities of digital technologies to destabilize hierarchical relations of power do not materialize within this era, prompting, yet again, more control and power to maintain normative structures in technology, dance, and gender.

Troika Ranch and their artistic work was emblematic of this "digital" era, from earlier work with motion capture technology to more recent performances adapting technological procedures within their creative process. Dancer and choreographer Dawn Stoppiello and musician and computer programmer Mark Coniglio formed their company in 1994 to question the relationship between humans and machines by dance, theater, and new media performances. Their performance of *loopdiver* opens up the discussion to reveal both the liberatory and oppressive elements of the cyborg.

With an extensive focus given to the digitally produced visual image, seduction and objectification problematically arose amongst their earlier work. The rendition of *loopdiver* from 2009 spoke about issues of trauma, both personally and more generally, as systematic of our relationship with technology. In the work, though, a focus shifted to tell a particular emotive and female cyborgian body's real and fictionally experience within a technologically mediated world. From the development of the software program *Isadora* to their aesthetic performances, concepts ranging from affective labor, kinesthetic affect and empathy, and sociological notions of the technical help to unpack all the nuances that occurred between gender, technology, and dance. From this pivotal work of *loopdiver,* TR's more recent works unravel a highly imaginative and innovative way out of these difficult scenarios that shifts the focus to more critical investigations of the body, a feeling and sensing body, alongside technological apparatuses that also shift notions of agency and affect.

Finally, a feeling of being disillusioned by the progress of digital technologies haunts the current moment. As Jeannette Winterson boldly comments, "Masculinity is in crisis, women are in crisis – this is the crisis generation" (2015, 5). The open source, hacking and DIY technology movements are perceived as progressive attempts to dismantle troubling hierarchical power structures, but the dominance of algorithms, networks, and interfaces continues to protect and hide away the source and power of code. In a nod to the body politic of the social movements, a focus and need to become more attuned to the kinesthetic sense and bodily awareness is arising again. Simultaneously, more control and stereotypical notions of gender persist, where an increasing backlash against feminist and social aims continues to offset and destroy progress made within socio-economic, technical, and cultural systems.

Within this context in the last chapter, I conclude with reflecting upon my own research-creation practice within a collaborative team that consisted of multiple gender identities and

expressions and of varying modes of expertise from disciplinary to interdisciplinary thought and institutional research labs. In the creative process, all collaborators had to negotiate the difficult interplay of power, values, and disciplinary thought that, at times, maintained the prescribed conditions of patriarchal systems. The performance event *Orbital Resonance* was an intra-active and digitally responsive space, where all agents, materials, and subjectivities were given space to affect all the different components in play (performers, audience, technology, and space).

With an attuned focus to the kinesthetic, we adapted strategies of displacement, improvisation, and somatic techniques to destabilize the power of vision and problematic binaries of male programmer vs. female performer. In an era of wireless technologies and unparalleled potentials of the Internet for more equality and equity, there is also a persistent and troubling need to revert back to stereotypical gendered relations and roles. *Orbital Resonance* was a research-creation performance using movement and media (sound, light, space and bodies) that aimed to present a different way of approaching these problematic and persistent socio-economically constructed ways of doing and being.

The prescribed and persistent normative structures in play within dance and technology are exhausting. I firmly believe in the potentials and beauty of performance as a critical practice to unpack and destabilize power structures and troubling binaries, but this can only occur when all agents, particularly humans, acknowledge their position, increase patience, and show care to create a collaborative exchange in the moments of creation and to share with other bodies through performance and dialogue.

Artistic Statement and Continuing Practice

As an emerging researcher, artist, and educator within interdisciplinary scholarship, I still question how the practice of combining movement and technologies can acknowledge the performativity of all agents through critical feminist and queer methodologies. Coming from dancing, the initiative to move and do provides a critical platform to understand human bodies in the context of larger systems and structures. I am interested in the way technology is designed and applied across multiple performative platforms and what this does to the gendered body. I am interested and hopeful in the way digital technologies can create open, liberatory spaces through the strategies of transformation, displacement, and new configurations of multiple

identities. In my work, multisensory immersive environments draw the body into the world of digital interactivity and give tangible weight to the presence of different materials as mediators of interaction across space and time.

I continue to explore affective and material processes of mess-making, trust-building and negotiation of space within interdisciplinary research and performance creation practices. Motivated by feminist Science and Technology Studies, the spilling-over and bleeding through of different modalities of thought and art-practices is necessary in order to counteract against the precise engineering of techno-capitalism and to foster the inter-connectedness of social bodies. It is a statement of presence and recognition of the traces of emotional consciousness that both drives and is politically structured by socio-technical interaction.

In one such iteration that addresses these affective and material processes, I performed and collaborated as a digital artist in an experimental transdisciplinary performance entitled *hold* involving hip hop and contemporary dancers Alexis Cormier and Jay Harvey, poet Ardath Whynacht, curator Peter Dykhuis, and indie pop composer John Mullane. A performance and discussion took place July 17 and 18, 2015 at the Dalhousie Art Gallery in Halifax, Nova Scotia, Canada. The work was an experimentation of a performance in an empty gallery space, dissecting themes of transient moments, of hold and release, and of locomotive movements.

In an act against disciplinary modes of thinking and doing, we forged different ways of working that acknowledged each other's differences from the various fields we represented to ultimately mess with our expertise and training. We wanted to give recognition to the tools and equipment of the gallery and the spaces less traveled. The sentiments of visual artist Bracha Lichtenberg Ettinger guided our performance, where she states "What matters is the event, the repetition of the event as performance art, and the repetition of the performance as performance art, the video, and all that followed from that moment on –the discussion, the conversation" (2005, 698). We opened up the conventional space of the gallery for a different purpose – to disrupt power and expertise by moving into more beneficial collaborative exchanges with each other as artists and with the audience.

In addition to this performance, I have pursued more collaborative exchanges during my studies in Montréal by meeting like-minded artists through the research center Studio XX. In one such encounter in 2012, I met Anne Goldenberg through my interest in her performance *Diaphanous Algorithm*. Because of our similar interests, we became friends and collaborated on

a work entitled *Black Magic | White Magic* presented as part of Laboratoire Phenomena at Casa del populo in May 2013. The work was an exploration of movement, sound, and technical devices (laptops, projectors, cords, and speakers) among three female performers. The intention was to pose a poetic, ironical and humorous glance of daily gestures, aesthetic, rituals, power, and fragility that are at stake in complex relationships between humans and personal computers. A variation of this performance was presented by Goldenberg and dancer Karine Rathle at the Tactical Magic Conference in Tasmania, Australia where I showed my support and feedback to the continuing artists during rehearsal periods in Montréal.

To continue my exploration with a more in-depth understanding of how to apply queer and feminist methodologies to create a critical art practice involving movement and technology, I have been invited by Goldenberg to collaborate on a new project. The work is framed as an experimental platform to create a 'cryptodance' that explores how to choreograph and communicate what cryptography is about, raising concerns about issues of security, privacy, surveillance, copyright infringement, and more through the different modalities of encryption. The collaboration is an international small constellation of choreographers, hackers, dancers, and designers interested in transdisciplinary feminist practices that includes Marthe Van Dessel, Anne Goldenberg, Karine Rathle, Ellen Foster, Nikolaos Chandolias, and myself. The event has occurred as part of the TransHackFeminist Meeting at Studio XX in Montréal, Québec, Canada in August 2016, the HTMLles Festival at Studio 303 in Montréal, Québec, Canada in November 2016, and the Flee Immediately: Dance and Code Festival at the Panke Gallery in Berlin, Germany in February 2017.

In my next work with collaborator Anne Goldenberg, "Sensing a Constellation," we aim to create a sensitive interface, to navigate a collection of traces from feminist healing decolonial hacking practices. As Goldenberg asks, "how can contemporary techno-feminism generate a constellation of hopes, solidarities, and intersectional practices in order to dance forward a desirable future?" (2016). I want to be more intersectional, whether this means taking a step back, becoming an ally, and giving solidarity and space to others. I want to be more vocal.

My investigation is not over, but a continuation to find better ways to research, to collaborate, to create, and to perform that accommodates all the messy entanglements that combine into creating technologically augmented dance. Artists are still debating the ongoing positive and negatives possibilities of interacting with technology and the human body,

problematizing the issue of agency in the process and performance event. As Anne Balsamo boldly states, "the challenge remains to think about how we can study and write about identity in such a way that the on-going production of identities is honored and recognized as a potential source of feminist empowerment in our postmodern era" (2000, 156). There is no resolution of this issue, nor may there ever be, but there are better ways of going about theory and practice that encourage more imaginative ways of creating and performing. Through this work, I hope to narrow a significant gap in scholarship and ways of approaching creative practice in a more critical manner that acknowledges queer and feminist methodologies from STS, performance studies, film, and communications in order to make a mess of prescribed normative structures in dance, technology, and gender.

Endnotes

Introduction

[i] Prominent examples of male technologist/female dancer collaborations include: Marie-Calude Poulin and Martin Kusch of kondition pluriel based in Canada, Jools Gilson-Ellis and Richard Povall of half/angel based in Ireland and England (though not practicing together anymore), Tina Tarpgaard, Jonas Jongejan, and Ole Kristensen of Recoil Performance Group based in Denmark, Sue Hawksley and Simon Biggs based in the UK, Emily Fernandez and Freider Weiss in Australia, Ruth Gibson and Bruno Martelli of Igloo based in the UK, and Claire Bardainne and Adrien Mondot of Adrien M/Claire B based in France.

[ii] For a more complete list of major publications from dance scholars, please see the resource list from the Society of Dance History Scholars: https://sdhs.org/resources/books-by-members.

[iii] In computer science academic programs, the numbers for women have dwindled dramatically since the advent of this field in American universities. In 1967, around 24 women were awarded a computer science bachelor degree out of 222 people that year, a percentage of around 11%. In 1984, women earning CS bachelor degrees peaked at 37%. In 2006 and continuing today, the proportion of women earning CS bachelor degrees has significantly declined to around 15-20% (Hayes, Ed. By Misa 2010, p.30). In the 2010 Bureau of Labor Statistics, the US Department of Labor estimates the percentage of computing occupations held by women are around 26%, wherein 3% are African-American women, 5% are Asian women, and 2% are Hispanic/Latina women (NCWIT.org 2014). Additionally, women studying in computer science or already employed in the technology industry are leaving at staggering rates. See also http://geekfeminism.wikia.com/wiki/Technology_industry

In an article in Dance Magazine in 2008, they boldly state, "Too often choreography is thought of as a man's job." See more at: http://www.dancemagazine.com/issues/April-2008/They-Are-Women-Hear-Them-Roar#sthash.Z4oi1guF.dpuf. From 2008-present, there is an onslaught of media attention attempting to grapple with the question: "where have all the women choreographers gone?", with a myriad of factors discussed. One factor is the accessibility to funding opportunities. One statistic from 2008 details the New York State Council on the Arts public funding of close to 2.2 million dollars to dance companies and choreographers, where "grants totaling $840,650, or 38 percent, were awarded to male choreographers or male-led companies; female-led companies received $597,550, or 27 percent. The remaining $760,200, or 34 percent, was awarded to companies led by men and women" (Rasbury 2008, p.1).

In JoAnna Mendl Shaw with Ellis Wood's *Gender Project: Women Hitting the Wall* in 2001, they studied male and female representation in America, noticing that when a company's budget is $500,000 to $1 million, most often there is a male artistic director (See Shaw, JoAnna Mendl, JoAnna Mendl Shaw, Rayna R. Reiter, Linda Marks, Ellis Wood, Janis Brenner, Tessa Nebrida, et al. 2001. *Women Hitting the Wall: The Gender Project,* New York Performing Arts Library). As renowned NYC choreographer, performer, and teacher Elizabeth Streb forthrightly states, "Where are today's female choreographers? Oh my God. When I came to New York, women ruled the roost, but there's been an attrition. I suspect it's harder for women to assume authority and captain their own ship. Also, people like to give money to men" (See http://www.rad.org.uk/news/where-are-the-women for more information).

[iv] In only two examples that he supplies (Lisa Naugle and Jools Gilson-Ellis), I am surprised that he left out some other key female choreographers that have written about their practice and about

the field more broadly, including Harmony Bench, Susan Kozel, Sarah Rubidge (retired), Gretchen Schiller, Thecla Schiphorst, Dawn Stoppiello, and Isabel Valverde.

[v] For more information, please see this list compiled of key texts relating to kinesthesia compiled by the Watching Dance Project based in the United Kingdom: http://www.watchingdance.org/research/KInesthesia%20Bibliography.pdf

[vi] A socialized behavior common among women in STEAM (science/technology/engineering/arts/math) fields that makes you feel unqualified and unworthy, identifying as a fraud. See more at https://adainitiative.org/what-we-do/impostor-syndrome-training/#adacamp

[vii] Other classes included jazz, tap, Dunham, West African, yoga, floor barre, Gyrokinesis®, and body conditioning.

[viii] OED defines the noun form, first published in 1889, as "a. the written notation of dancing and b. the art of dancing" and the verb form, not published until 1972, as "a. to compose the choreography of (a ballet) and b. to engage in choreography" (OED, 2015).

[ix] Issues of authorship and/or ownership are still left unresolved in the field of dance. In the United States, the Federal Copyright Law of 1976 legally grants copyright ownership to choreographic works if eligible, separate from the previously existing categories of dramatic and/or dramatico-musical works. There are still no clear definitions of choreography or dance, but an ambivalent and challenging set of guidelines, particular for dance, to copyright easily. As Canadian-born and New York City based choreographer Noémie Lafrance boldly states, "Because of entrenched misconceptions, it has proven difficult to defend choreographers' rights to authorship. It has become common to question whether choreographers are actually authors…I think it is time that we put an end to the discrimination that exists against dance artists in the courts of law, the media, and educational and arts institutions" (2014). In one of the earliest cases of *Fuller vs Bemis* in 1892 that denied choreographer Loïe Fuller protection of her work to present times, many issues remain, legally and otherwise, in the domains of authorship and ownership of dance works. The stakes in this manner are quite high; implicating commoditized and objectified bodies, disembodied representations, devalued status, and financial ruin. For a more detailed analysis of copyright law and regulations in choreographic works, please see (Van Camp 1994; LaFrance 2014; Kraut 2015).

[x] From John L. Austin's linguistic interpretation, Judith Butler shifted the understanding of performativity to gender. She uses performativity to describe how one performs gender identity through repetitive acts of doing, "suggest[ing] a dramatic and contingent construction of meaning" (Herzig 2004, 128).

[xi] As dance scholar Peter Ryan details, "Contact improvisation was a marginalized process-based technique, focused for rehearsal time and for movement research possibly due to the tendency of this form regarded as a tool and not performance-worthy and to the non-authoritative stance the participants undertook…the form was so new and assumed so much: openness, vulnerability, physical risk in a nebulous context, creativity on a cellular level, the willingness to make and accept mistakes" (Ed. By Dils and Cooper Albright 2001, 419).

[xii] This is not to say all cultures do not consider dance a central form of knowledge. Although folk dancing has been a prominent feature of most cultures around the world, historically, there have been prominent examples in eastern countries, like that of Vedic and later, Hindu cultures, Balinese, Dragon dances of Han Dynasty, and more, that have valued the body as a source of knowing. This is not a main focus of my argument, but recognition needs to be given in

acknowledging cultures outside of the norm that have indeed given prominence to dance and the body.

[xiii] Throughout each case study, I want to uphold my feminist intention to analyze using the concept of intersectionality to discuss all the different components of power within the realms of dance, technology, and gender, even as the case studies discussed here include only Caucasian artists from the Western world. Intersectionality is a concept developed to understand the interdependence and examination of all parts together, to understand "the relation between systems of oppression which construct our multiple identities and our social locations in hierarchies of power and privilege", coined by legal scholar Kimberlé Crenshaw in 1989 (Carastathis 2014). The lack of diversity goes beyond gender in this field, in which a need to close the significant gap in research and bring more accessibility in practice needs to occur. These actions deserve substantial attention that go beyond the confines of this dissertation.

[xiv] As artist and academic Chris Salter explains, "technology already revealed itself in the fifth century Athenian stage as *machinae* intimately bound up with the fate of human beings…the Hellenic theater already plays out dramas between human and machine" through the use of the "cranelike *deus ex machina"* tool. In addition, the word technology originates from the Greek word *techne* meaning "craft, skill, construction, or making" (Salter 2010, xxii).

[xv] American neurologist George Miller Beard boldly claimed that a body's energy was finite because of the demands of civilization. He encouraged audiences to conserve their own energies, for example, stating that women should not engage "in advanced study because brain work drained from the body energy that could be better used for reproduction" hence supporting binary hierarchies of gender (Thomas de la Pena 2003, 5).

[xvi] A docile body is a body that "may be subjected, used, transformed, and improved" upon (Foucault 1977, 180).

[xvii] Jean-Martin Charcot's two medical orderlies, Breton and Aragon, admitted to that fact (LaCoss 2005, 38).

[xviii] For more detailed analysis from their writings and works, see Jaques-Dalcroze 1913; Findlay 1995; Taylor 1911; Aitken 2014; Alexander ed. by Daniel McGowan 1997; Chance 2013; Bartenieff 1980; Laban 1974; Laban ed. by Lisa Ullmann 2011; Guest 2013).

[xix] A problematic representation of "women as reproduced art objects" (Garelick 1998, 82).

[xx] The gramophone, an invention by Edison, could "store and thereby separate as such, sound, faces, and documents." Media theorist Friedrich Kittler argues these inventions began the "mechanization of information…making today's self-recursive number stream possible" (Kittler, ed. by Johnston 1997, 29).

[xxi] In *Bodies and Machines*, Mark Seltzer cites Graham Barker-Benfield's study of Victorian American women, stating, "one of the governing impulses promoting the medicalization of women and childbirth in the nineteenth century was the [male] desire 'to take charge of the procreate function in all of its aspects" (Seltzer 1992, 28).

[xxii] The body expectations of dancer's body can lead to an array of complications, more recently understood as body dysmorphic disorder, eating disorders, and other health complications.

[xxiii] Although a convincing argument, McCarren makes no reference to Frank Kermode, who not only connected Loïe Fuller to hysteria himself, but also noted Charcot's theatrically at the Salpétriere hospital, as it "was used as a kind of alternative music-hall" (Kermode 1976, 29).

[xxiv] For a further discussion of Fuller's U.S. Patents ("Garment for Dancers" No.518347, "Mechanism for the Production of Stage Effects" No.513102, and "Theatrical Stage Mechanism"

No.533167) see (Albright 2007, 185-187). Additionally, Albright views Fuller as "discovering" lighting effects. However, Fuller has no patents of specific lamps or other technological apparatuses and inventions, see Larry Wild's "A Brief Outline of the History of Stage Lighting" at http://www3.northern.edu/wild/LiteDes/ldhist.htm#educators (accessed April 13, 2013).

[xxv] Marinetti famously labeled Fuller as the ideal dancer in his *Manifesto of Futurist Dance* (1917). Similar to Mallarmé, they both reinforced Fuller's depersonalization by removing her body on the stage. Fuller showed only the "multiplied body of the motor" by becoming "metal, machine, and electricity" (Coffman 2002, 94).

[xxvi] Theodor Adorno and Max Horkheimer, influenced by Marx and Freud, discussed the relationship of the body to nature in the 1940s. They believed that "culture defines the body as a thing which can be possessed…nature takes its revenge for the fact that man has reduced nature to an object for domination, a raw material. The compulsive urge to cruelty and destruction springs from the organic displacement of the relationship between mind and body" where "the physical aspect of existence is taboo—an object of attraction and repulsion" (Adorno and Horkheimer 1944, 233). As nature was always associated with the female, men viewed female bodies in these same terms.

[xxvii] There are few scholarly articles about Giannina Censi in English, as most primary sources or additional interpretations are in Italian. There are no published books solely on futurist female performers.

Chapter 2

[xxviii] For more information about the specificity of the work, please see Vincent Bonin's description at http://www.fondation-langlois.org/html/e/page.php?NumPage=626

[xxix] For a list of the two sequences, see http://www.fondation-langlois.org/pdf/e/carriage_discreteness_en.pdf

[xxx] As editor-in-chief of *Artforum* Michelle Kuo describes, the Theatre Electronic Environmental Modular (TEEM) was a "system for wireless remote control of lights, sound, video, and other effects. It was the master network of *9 Evenings,* comprised of nearly three hundred components and used in some manner by all the artists in their pieces. Klüver described TEEM as the first electronic system built for onstage use and a step toward the possibility when the computer could be part of an actual performance" (2013:272).

[xxxi] The work of Hay and Childs in *9 Evenings* reveal strategies similar to Rainer.

[xxxii] Fredric Jameson argues that the forces in play during the 1960s are "new ones, on which the older methods do not necessarily work. We have described the 60s as a moment in which the enlargement of capitalism on a global scale simultaneously produced an immense freeing or unbinding of social energies… Yet this sense of freedom and possibility-which is for the course of the 60s a momentarily objective reality, as well as (from the hindsight of the 80s) a historical illusion-may perhaps best be explained in terms of the superstructural movement and play enabled by the transition from one infrastructural or systemic stage of capitalism to another" (1984:208).

[xxxiii] For more information on this matter, see the journals of Simone [Forti] Whitman, "A View of 9 Evenings: Theatre & Engineering," 1966, manuscript, 20, E.A.T. Records 940003, box 2, folder 16, where she comments on the situation of the artists undergoing "engineer-directed" activities.

[xxxiv] After the 1980s, women's participation and involvement in computer science steadily decreased.

[xxxv] Within the women's movement, three distinct groups forged the path to end inequality within both the social and political realms: white, middle class women either in liberal organizations such as the National Organization of Women (NOW) or more radical movements within the New Left; African-American, Puerto Rican, and Chicana women in addition to their fight against racial and class injustices within the civil rights movements; and lesbian feminists. Liberal, white feminists "worked through accepted political channels to seek equality for women in the existing system….while radicals sought to remake that society" (Bailey 2001, 127). In NOW's Statement of Purpose, written by Betty Friedan in 1966, demanded equal pay and equal employment opportunities regardless of sex, race, religion, and national origin. They included other oppressed groups within their political aims, but were not equipped to deal with highly troubling issues of abortion, rape, sexual harassment, and more. Representing the New Left, student activists formed the newly named Students for a Democratic Society in the early 1960s where women were increasingly productive as effective organizers and as managers across both racial and class divides, but problems were on the horizon. Their "background, education, ideology, and experience all primed the New Left women for equality. Yet their experience in the national movement was confusing, grating…in public, at the big national meetings, women had trouble making themselves heard…Ambition, expected in a man, looked suspiciously like ballbusting to the male eye" (Gitlin 1987, 367-368). Within a typical gate-keeping boy club attitude of fraternities and tough competition, it was difficult for women to find their place even in an atmosphere supposedly supportive of their cause.

[xxxvi] Referred to more as Cage's children than Cunningham's, the teachings of Zen Buddhism, chance procedures, the collective process, and the value of the everyday heavily influenced the diverse range of choreographic styles that grew out of the Judson Dance Theater. One such choreographic style was labeled postmodern dance, defined as a practice of objectivity incorporating a diverse amount of artistic practices, and an analytic expression governed by concepts, rules, problems, and more (Kirby 1975; Banes 1980; Bertens 1995).

[xxxvii] In a pertinent discussion around innovation, historian scholar W. Patrick McCray raises important concerns from this decade on how innovation has and is defined from academy to national policies. Historically, "automation and innovation, from the 1920s through the 1950s, displaced tens of thousands of workers" by the increase in research and development policies supporting goal-oriented technological achievements, from the space race to the electric computer (2010, 6). Currently and "albeit a narrower form of newness in technological innovation," political leaders depend on this ability to foster "jobs, prosperity, and economic growth (Ibid.). Innovation is tied to a national agenda, although the collaborative teams and ability to produce always foster a transnational team to get the job done.

[xxxviii] It was not uncommon to see a range of both male (Forsythe) and female choreographers (Childs) using technological apparati to dictate movements from an offstage position.

[xxxix] The word "hacker" originates from MIT, where MIT students cleverly devised college pranks and referred to these as hacks, "but as the TMRC (the Tech Model Railroad Club) people used the word, there was serious respect implied…it would be understood that, to qualify as a hack, the feat must be imbued with innovation, style, and technical virtuosity" (Levy 1984,8).

[xl] The online space for self-identified female 'geeks' is quite rampant and ever growing. Some examples include http://www.girlgeeks.org/, http://www.genderchangers.org,

http://www.geekgirlcon.com/, http://geekfeminism.wikia.com– all with the purpose of celebrating and encouraging woman in science and technology. The term 'geek' and image of such has not been changed in these situations, but re-appropriated to include girls.

[xli] MIDI stands for Musical Instrument Digital Interface

[xlii] Interactive work (at least in one geneaology) owes itself to computer music, for example, the work of Iannis Xenakis, John Cage, David Rokeby, Roy Ascott, Dr. Garth Paine, and many more.

[xliii] As Margaret Morse critically states, "Poetic innovation did take place, albeit rarely, and Kozol apparently reveled in the expansion and contraction of her body boundaries as she identified with the body in the screen image…Experiencing a vicious attack on her virtual body underlined the way in which virtual and material bodies were intertwined. Thus, the assumption that the virtual is a separate realm of free play without actual consequences is misguided" (Morse 1997, 1).

Chapter 4

[xliv] This phenomena is described in more detail in Donald O Hebb, *Essays on Mind*. New York, NY: Psychological Press, 1980. In psychological and psychiatric fields, the nature of sensory deprivation or perceptual isolation is linked to effects such as relaxation, meditation, or more extreme cases of anxiety, depression, hallucinations, and more.

[xlv] For a more detailed description of the scenography and all elements researched, please visit: http://orbitalresonance.weebly.com/.

[xlvi] Richard Stallman initiated the FLOSS movement in 1983 to aid in his creation of an operating system composed completely by free software. The FLOSS movement refers to both Free Software and Open Source Software. Free Software "puts the emphasis" on four different types of freedom: "the freedom to use the software for any purpose, freedom to study and modify its source code, freedom to share and redistribute the software, and the freedom to improve the software and release your version of it to the public" (Mansoux and Valk 2008, 7). The Open Source Software tries to "avoid the philosophical and political implications of the interpretation of free as in freedom," perhaps trying to "appeal more to the corporate world" (Ibid.).

[xlvii] For more information see Dubberly, H., Haque, U. and Pangaro, P. "What is interaction? Are there different types?" *ACM Interactions*, Vol. 16, No. 1, 2009, pp.69–75 and Lympouridis, Vangelis. PhD Thesis. University of Edinburgh, 2012, pg. 45-49.

[xlviii] For more information on the x-OSC device, please see http://www.x-io.co.uk/products/x-osc/.

[xlix] For more information, please see (Dicker and Piepmeier 2003)

[l] In a pertinent article in response to the backlash of British choreographer Akram Khan's controversial statement of "Don't have more female choreographers for the sake of it" drawn out of context, a transnational collective of dance scholars and artists of colour responded in an article entitled "Writing from Silence" that is accessible at: http://londondance.com/articles/features/writing-from-silence-transnational-collective.

[li] See (Endnote: Introduction, Note IV) for statistical data and more details.

[lii] In Melanie Pinola's article "We aren't Imagining It: The Tech Industry Needs More Women", her statistical data reveals that "At major tech companies, women make up about 30% of the employees, but if you look closer, the numbers are more disturbing: women make up only about 16% of the technical roles (the people who make the stuff) and only 23% of the leadership roles

(the people who decide what gets made and how). Only 6% of the chief executives of the top 100 tech companies are women. Despite having the same high-quality education, 55% of women in business roles in tech industries start at an entry-level position, compared to 39% of men. Men in Silicon Valley make 52 to 61% more than women who have the same educational training." For more information, see: http://lifehacker.com/we-arent-imagining-it-the-tech-industry-needs-more-wom-1743737246.

[liii] Please see http://vimeo.com/14222503 for her entry.

[liv] One Example of an Improvisational Exercise Using Text and Movement:

Word: Heartbeat **Action**: Feel It, Express It, Change It

Written Reflection: *I couldn't locate my heartbeat immediately as I was yearning to close my eyes. My heartbeat meshed with the beat of the ambient noises: ventilation systems, people walking up and down the stairs, cell phones vibrating. When shifting between jumping to lying on the ground on repeat, my heartbeat shifted in a million different directions. There was an intention to share our heartbeats, difficult and intimate, but not necessarily emotional. With very little movement, we both concentrated on the microscopic actions of our bodies.*

Word: Breath **Action:** Switch Between Directional and Durational

Written Reflection: *Gasping, crawling…a monster underneath. Relax. A felt presence. Switching between fast, gut-wrenching breathes that forced energy out to slow, weighted breaths that brought relief back into my body. Huge emotional feelings rising to the core. Breathing into the joints, squeaks and squishiness emerge.*

[lv] David Z. Saltz, "Media, Technology, and Performance." *Theatre Journal*, Vol. 65, Number 3, October. The John Hopkins University Press, 2013, 422.

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Figures

Chapter 1: *The Electricity Fairy:* Technologies and Techniques of Loïe Fuller in Modernist Times

Figure 1. *La Loïe Fuller*. Poster by Pal (Jean De Paleologue), 1897.

Figure 2. Loïe Fuller. *Serpentine Dance*. Photograph by B.J. Falk. Jerome Robbins Dance Division, New York Public Library for the Performing Arts, 1892.

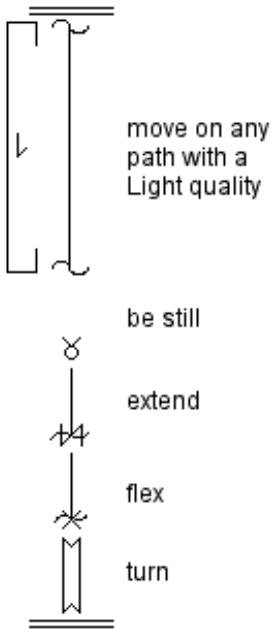


Figure 3. *Motif Notation*. Dance Notation Bureau, Ohio State University, 2016.

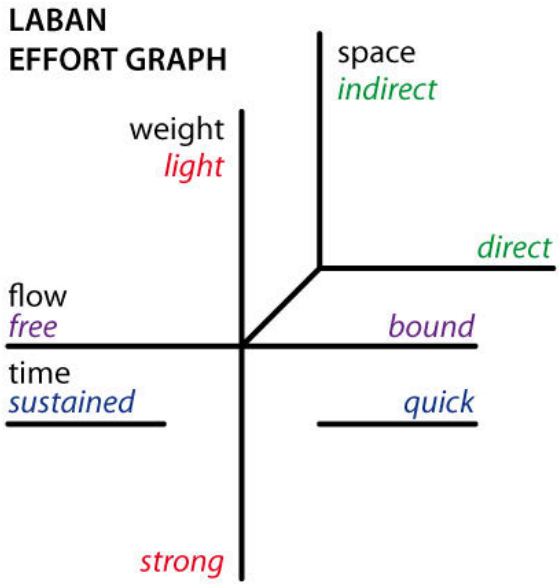


Figure 4. *Laban Effort Graph*. Created by: Raphaël Cottin, 2010.

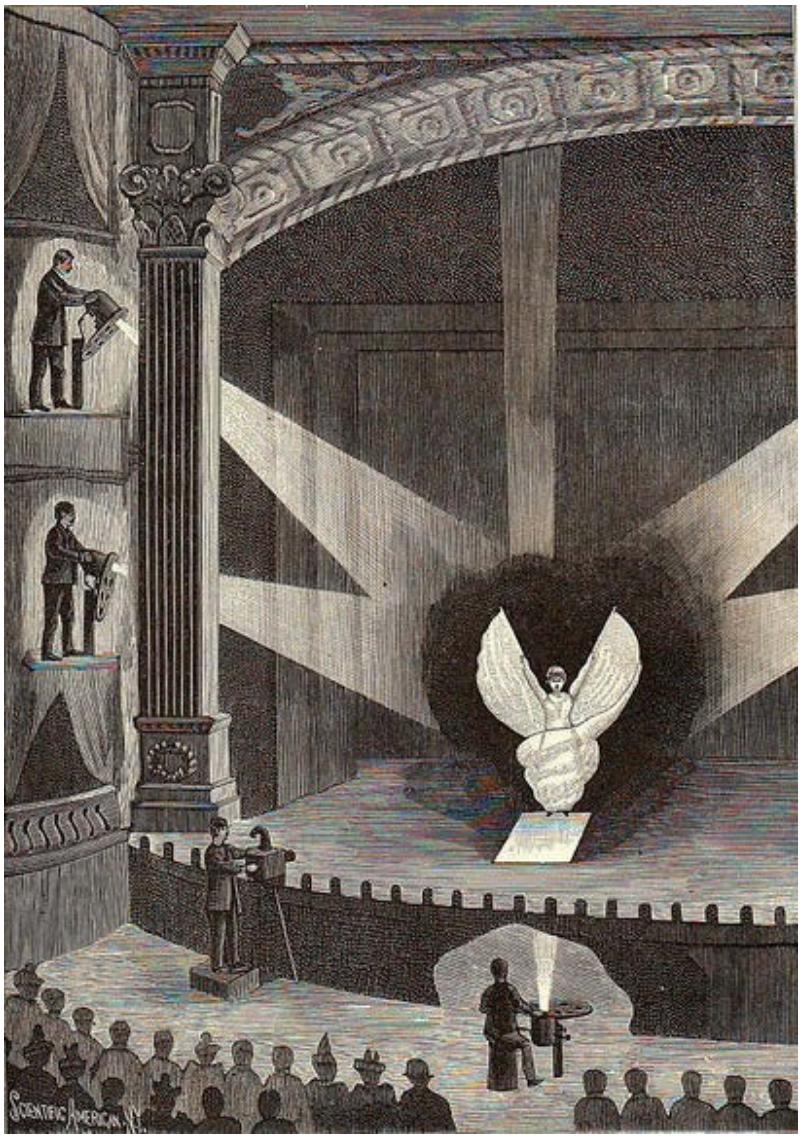


Figure 5. (Untitled illustration). Originally published in *Scientific American* June 20, 1896. From Hopkins, Albert A., *Magic: Stage Illusions and Scientific Diversions, including Trick Photography*, Munn & Co., New York, 1901.

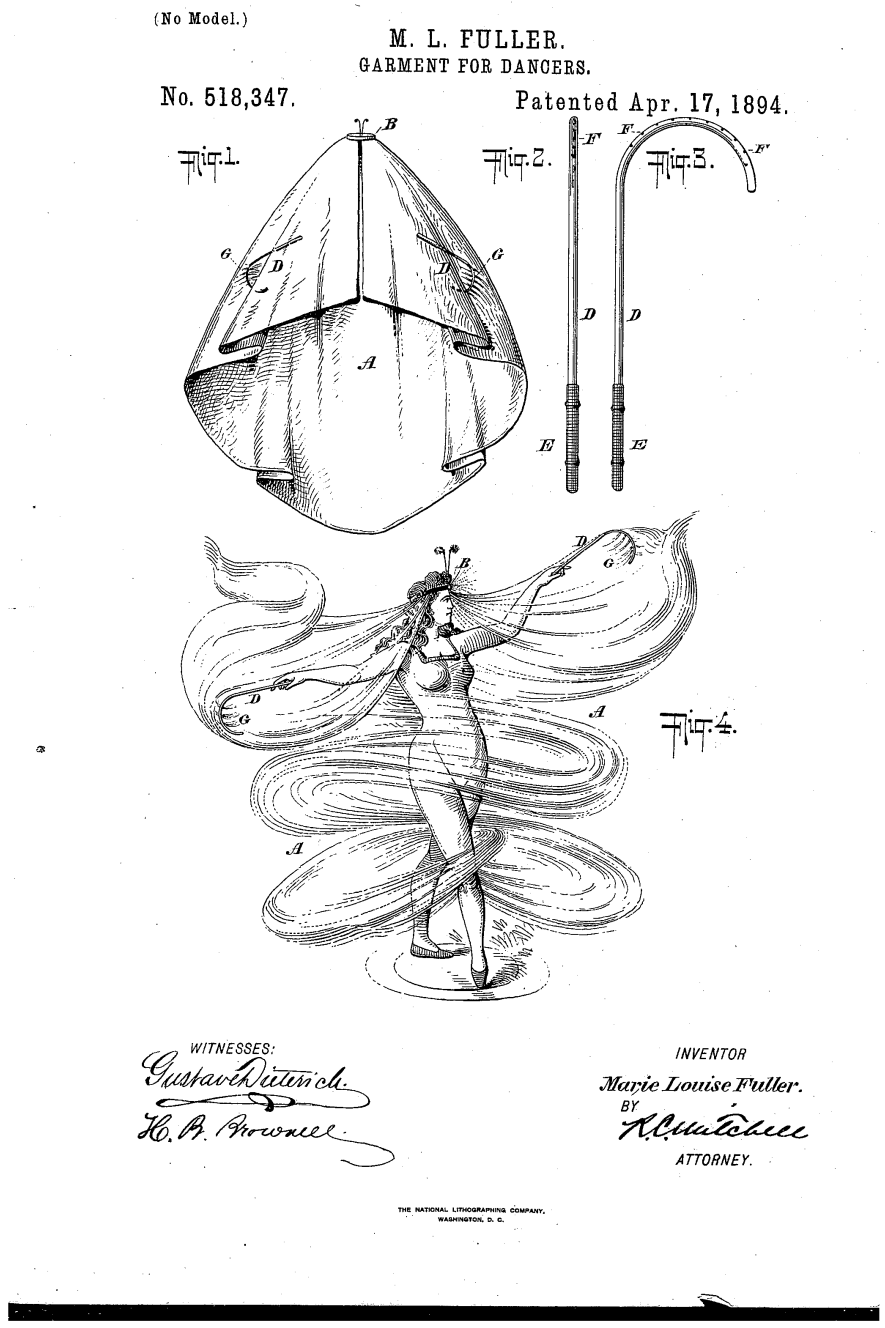
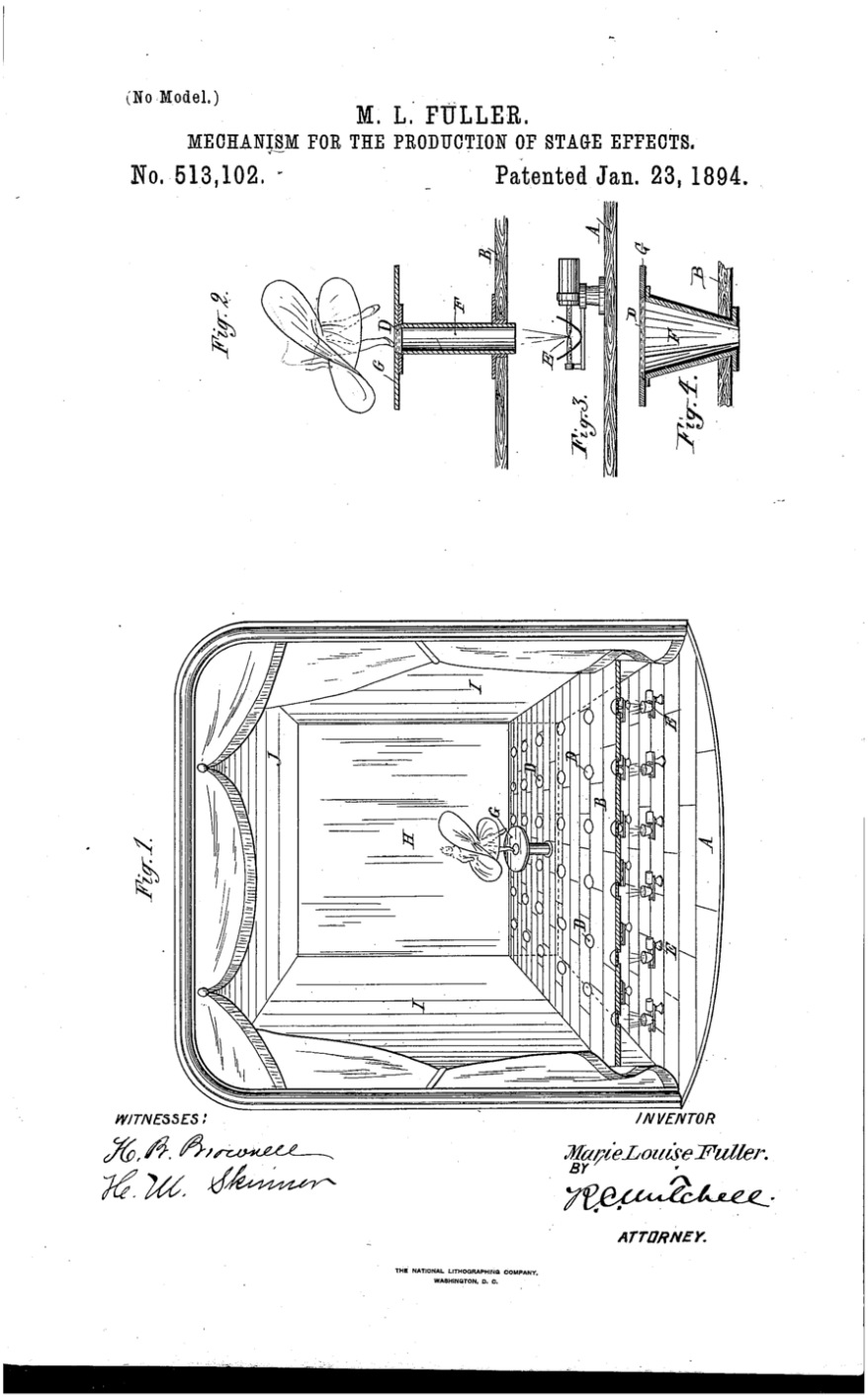


Figure 6. Marie Louise Fuller. GARMENT FOR DANCERS. No. 518347. Patented Apr. 17, 1894, United States Patent Office.


(No Model.)

M. L. FULLER.

MECHANISM FOR THE PRODUCTION OF STAGE EFFECTS.

No. 513,102. Patented Jan. 23, 1894.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 1.

WITNESSES:

H. B. Brownell

H. W. Skinner

INVENTOR

Marie Louise Fuller.

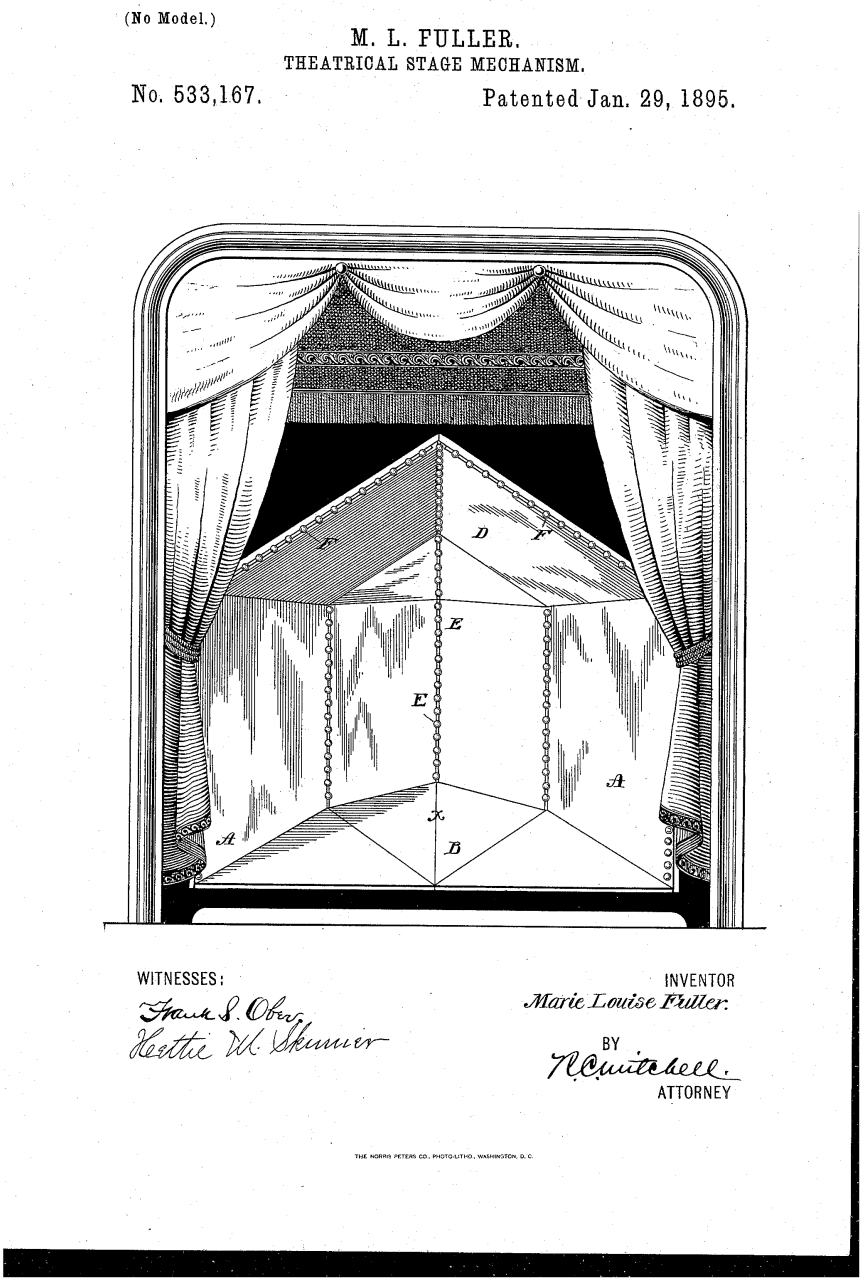
BY

R. E. Mitchell.

ATTORNEY.

THE NATIONAL LITHOGRAPHING COMPANY, WASHINGTON, D. C.

Figure 7. Marie Louise Fuller. MECHANISM FOR THE PRODUCTION OF STAGE EFFECTS. No. 513102. Patented Jan. 23, 1894, United States Patent Office.


(No Model.)

M. L. FULLER.

THEATRICAL STAGE MECHANISM.

No. 533,167. Patented Jan. 29, 1895.

WITNESSES:

Frank S. Ober.

Hettie M. Skinner

INVENTOR

Marie Louise Fuller.

BY

N. C. Mitchell.

ATTORNEY

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

Figure 8. Marie Louise Fuller. THEATRICAL STAGE MECHANISM. No. 533167. Patented Jan. 29,1895, United States Patent Office.

Figure 9. Fuller. Untitled. Photograph attributed to Samuel Joshua Beckett, c.1898. Musée d'Orsay, Paris.

Figure 10. *Folies Berger: La Loïe Fuller*, 1895, Poster By Jules Chéret

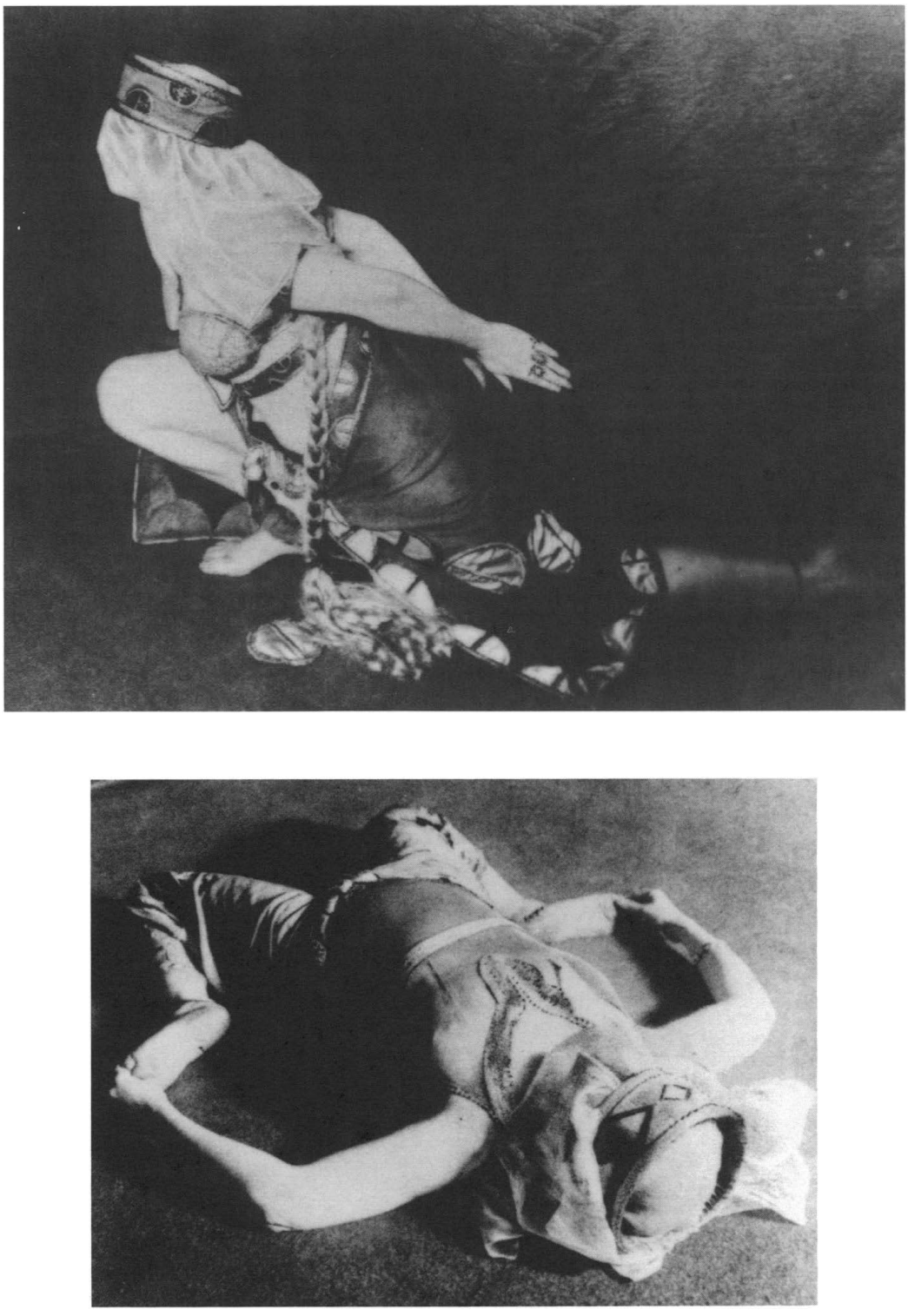


Figure 11. Valentine de Saint-Point. *Figure de la Métachorie*, poème d'atmosphère. Photograph 1913, The New York Public Library at Lincoln Center.

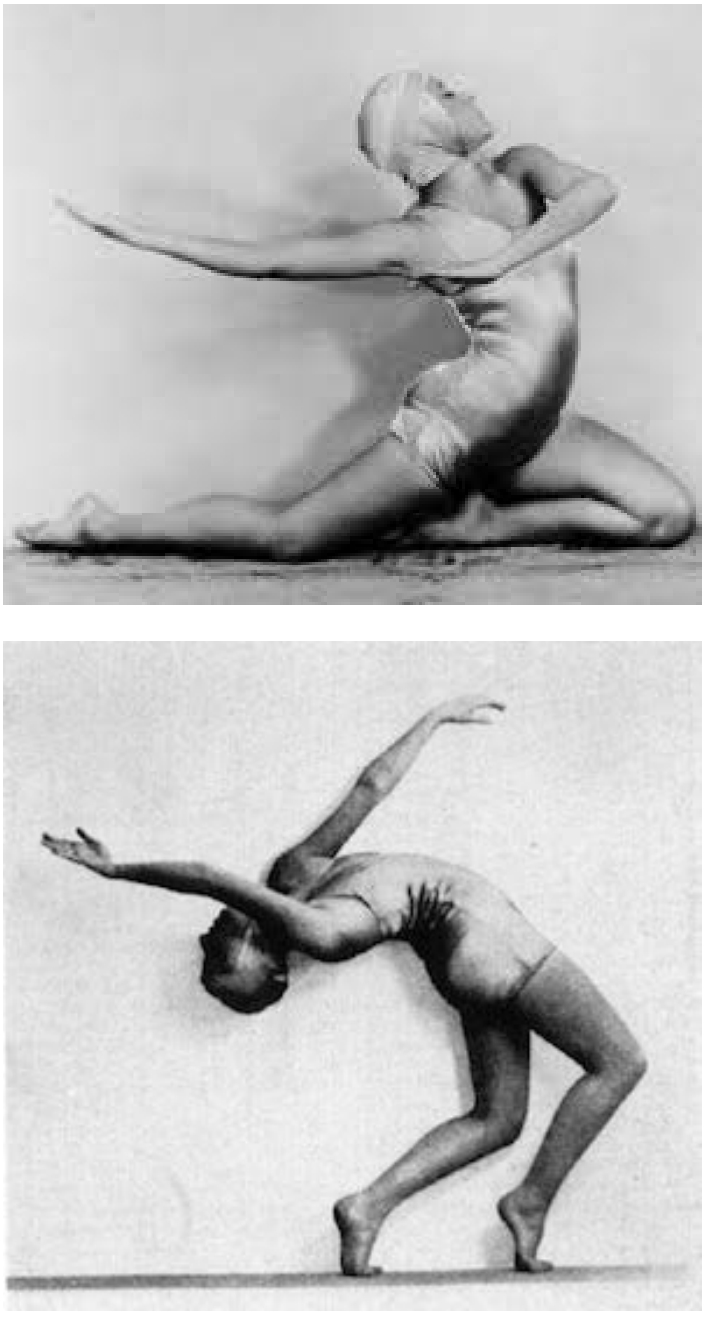


Figure 12. Giannina Censi. *Aerodanza*. Vesuario de E. Prampolini, 1931.

Figure 13. *9 Evenings* Poster, Designed by Robert Rauschenberg, 1966.

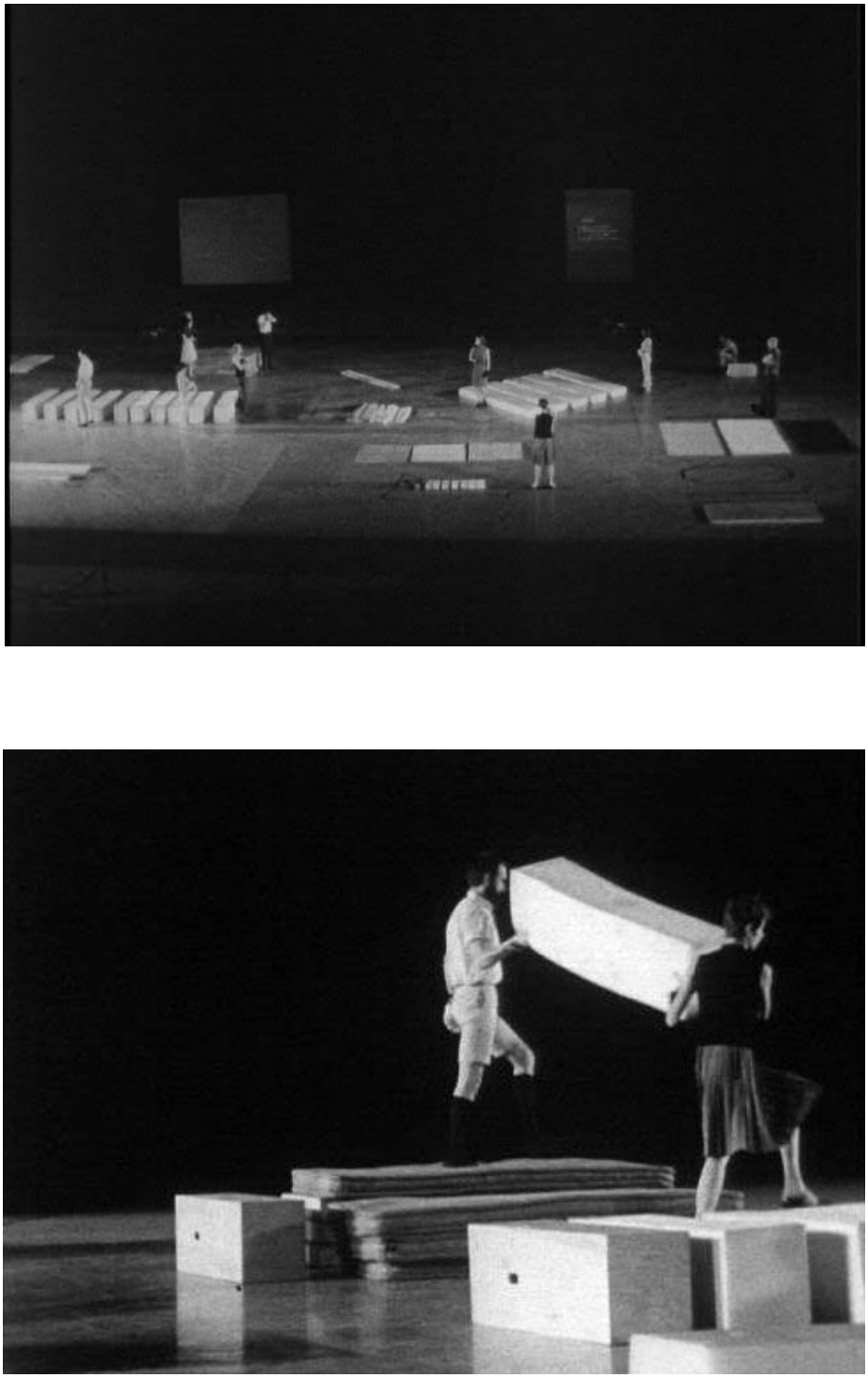


Figure 14. Yvonne Rainer, *Carriage Discreteness*. Performance presented as part of *9 Evenings: Theatre and Engineering*, The 69th Regiment Armory, New York, N.Y., United States, Still from the factual footage shot in 16 mm film by Alfons Schilling. The Daniel Langlois Foundation for Art, Science, and Technology, *9 Evenings: Theatre and Engineering fonds*, October 15-21, 1966.

Figure 15. View of the control booth during 9 Evenings. Still from the factual footage shot in 16 mm film by Alfons Schilling. The Daniel Langlois Foundation for Art, Science, and Technology, *9 Evenings: Theatre and Engineering fonds*, 1966.

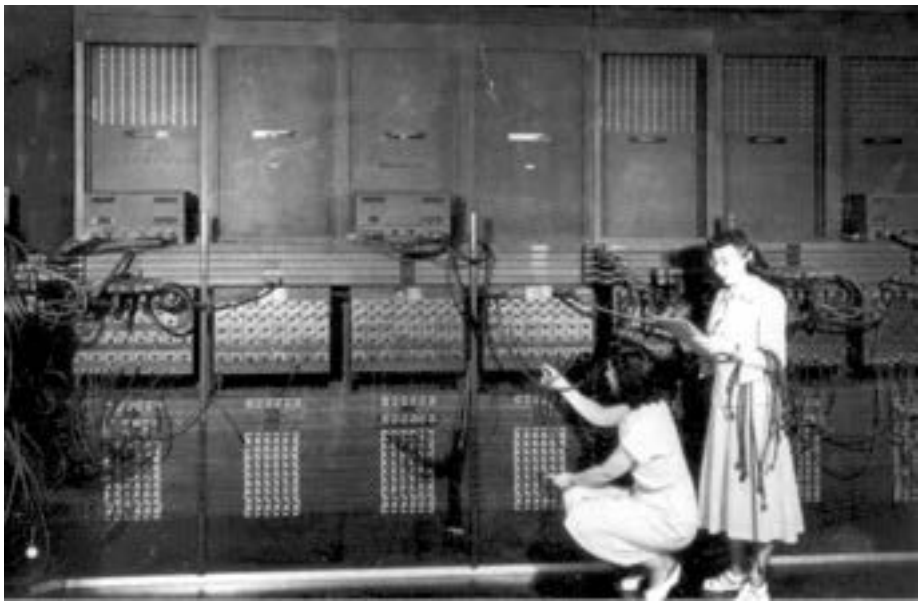


Figure 16. Two women wiring the right side of the ENIAC with a new program, in the "pre- von Neumann" days. "U.S. Army Photo" from the archives of the ARL Technical Library. Standing: Marlyn Wescoff Crouching: Ruth Lichterman, Unknown date.

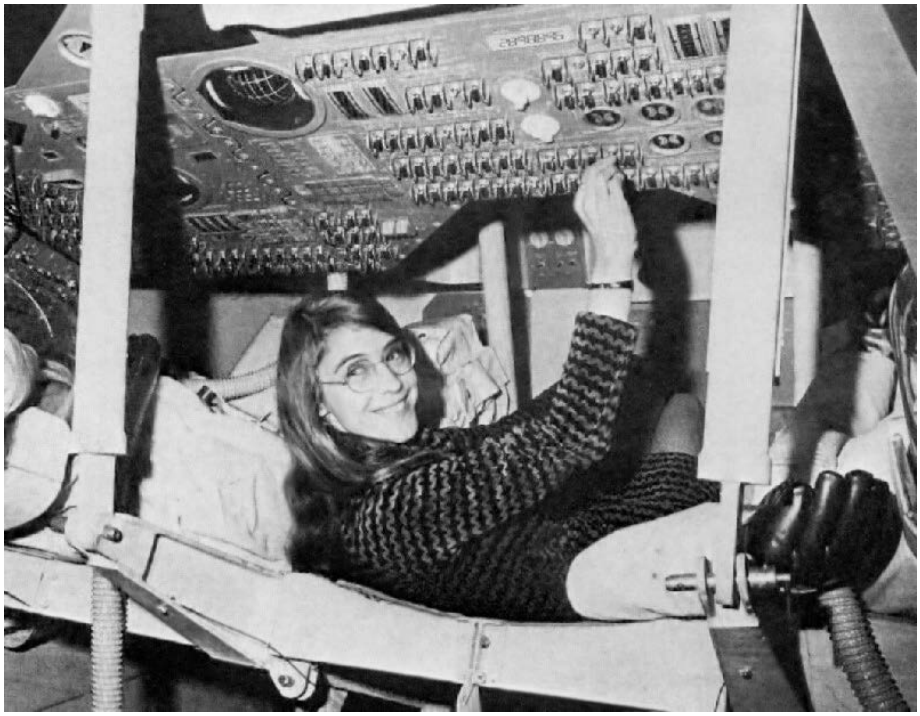


Figure 17. Margaret Hamilton, lead Apollo flight software engineer, in the Apollo Command Module, NASA, Unknown date.

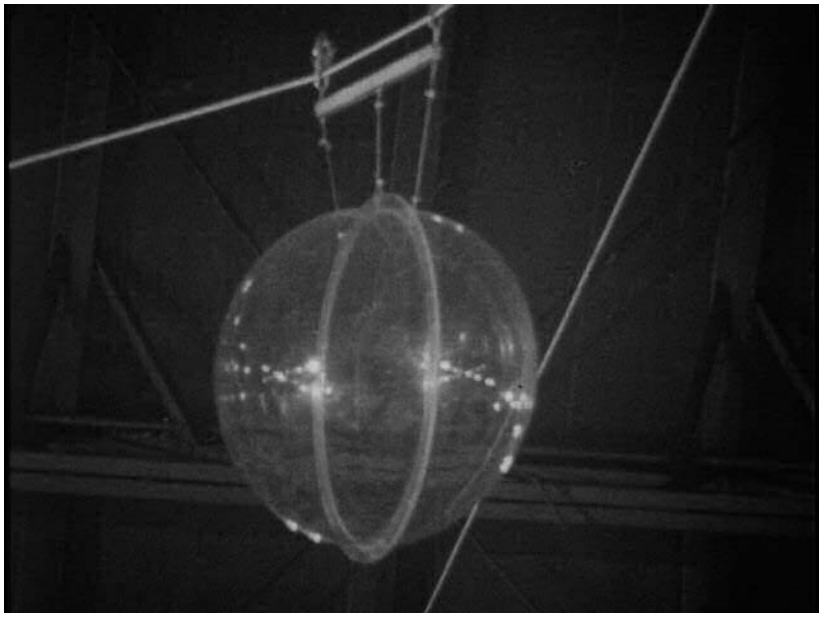


Figure 18. Yvonne Rainer, *Carriage Discreteness*. Performance presented as part of *9 Evenings: Theatre and Engineering*, The 69th Regiment Armory, New York, N.Y., United States, Still from the factual footage shot in 16 mm film by Alfons Schilling. The Daniel Langlois Foundation for Art, Science, and Technology, *9 Evenings: Theatre and Engineering fonds*, October 15-21, 1966.

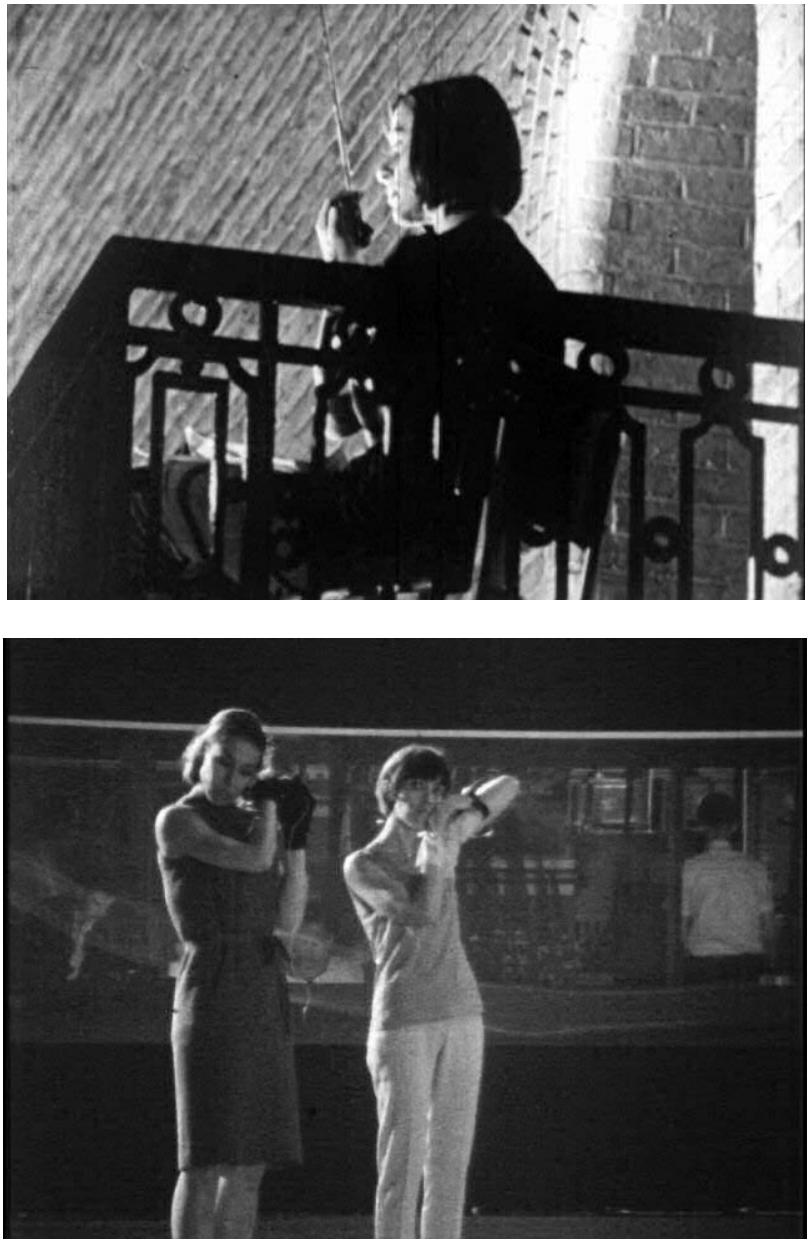


Figure 19. Yvonne Rainer, *Carriage Discreteness*. Performance presented as part of *9 Evenings: Theatre and Engineering*, The 69th Regiment Armory, New York, N.Y., United States, Still from the factual footage shot in 16 mm film by Alfons Schilling. The Daniel Langlois Foundation for Art, Science, and Technology, *9 Evenings: Theatre and Engineering fonds*, October 15-21, 1966.

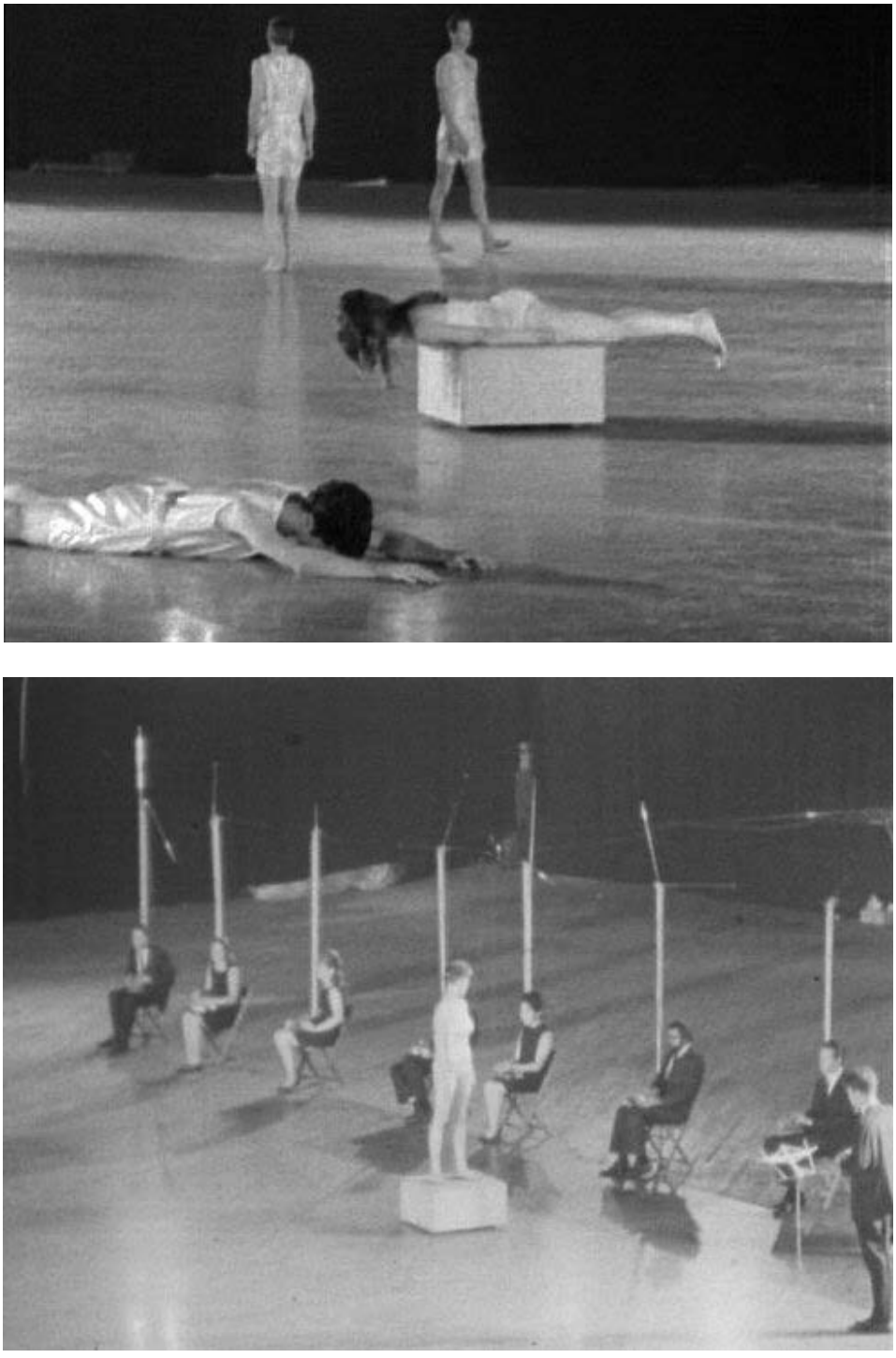


Figure 20. Deborah Hay. *Solo*. Performance presented as part of *9 Evenings: Theatre and Engineering*, The 69th Regiment Armory, New York, N.Y., United States, Still from the factual footage shot in 16 mm film by Alfons Schilling. The Daniel Langlois Foundation for Art, Science, and Technology, *9 Evenings: Theatre and Engineering fonds*, October 15-21, 1966.

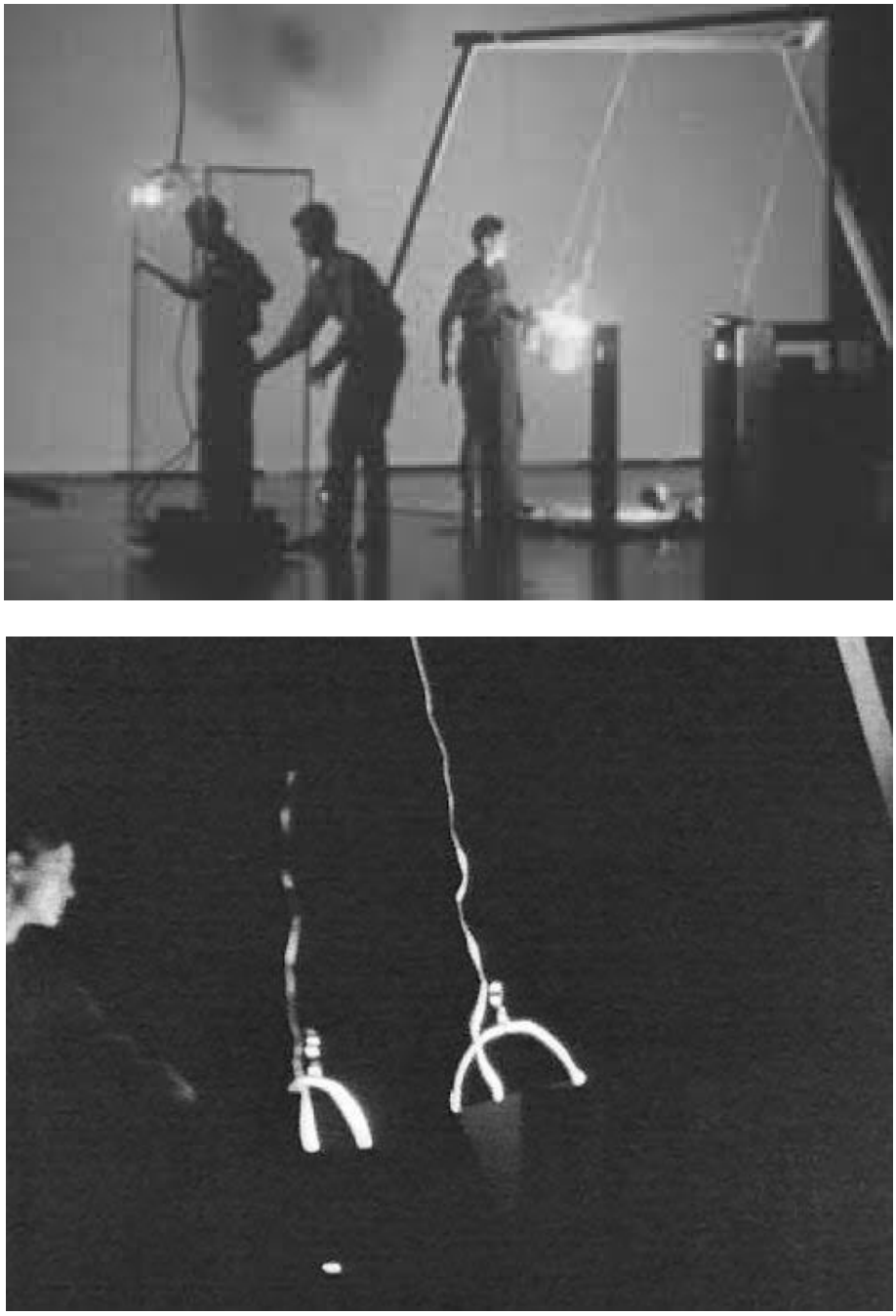


Figure 21. Lucinda Childs. *Vehicle*. Performance presented as part of *9 Evenings: Theatre and Engineering*, The 69th Regiment Armory, New York, N.Y., United States, Still from the factual footage shot in 16 mm film by Alfons Schilling. The Daniel Langlois Foundation for Art, Science, and Technology, *9 Evenings: Theatre and Engineering fonds*, October 15-21, 1966.

Figure 22. Troika Ranch. *loopdiver*, Dance Center of Columbia College, Chicago, Photo By: Alexandra Matzke, 2010.

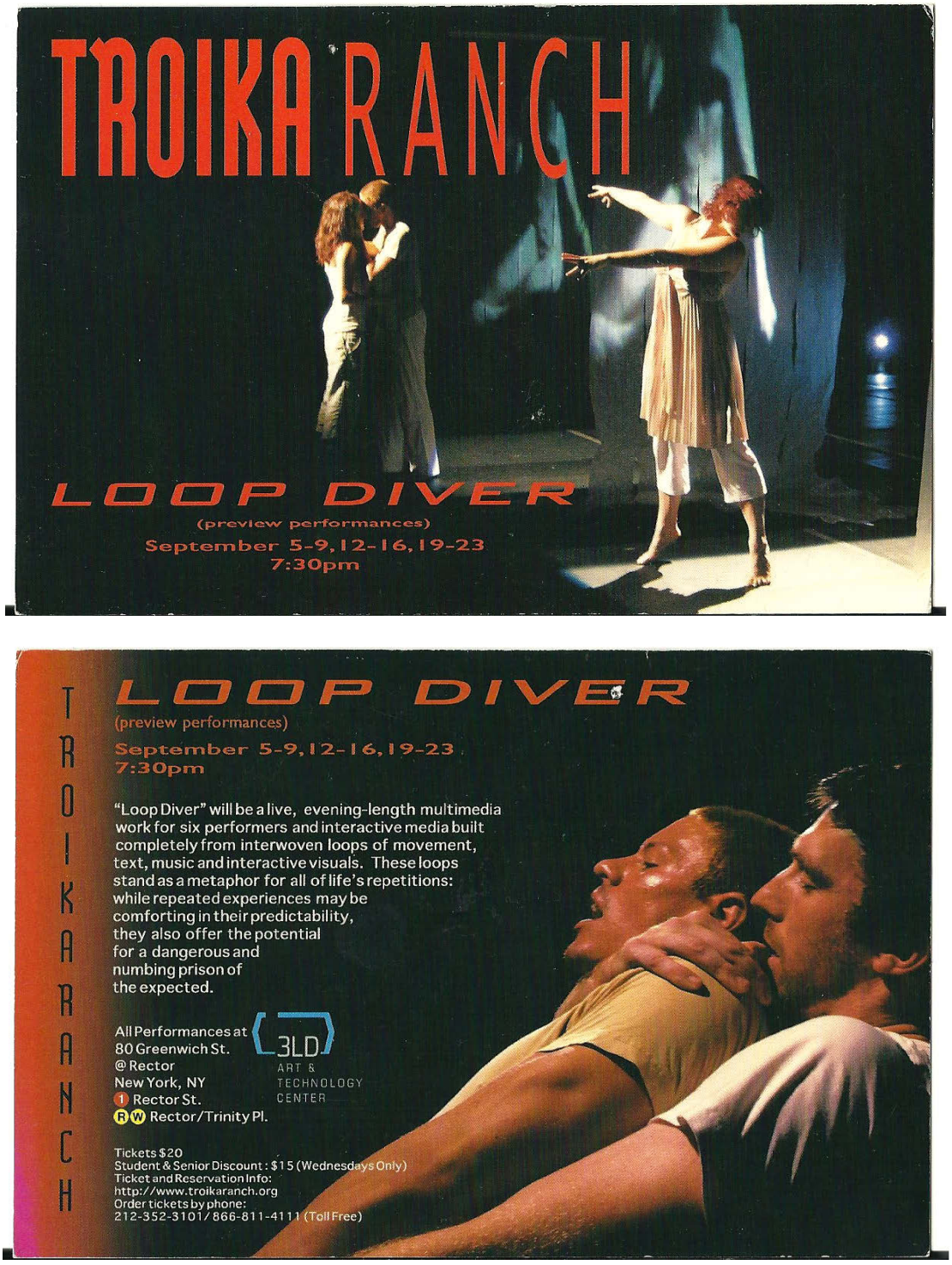


Figure 23. Troika Ranch. *loopdiver* Promotional Material. 3LD Art and Technology Center, New York, NY, 2007.

Figure 24. Dawn Stoppiello, "Cable Monster," Photo By: Piro Patton, 2001.

Figure 25. TroikaTronix. *Isadora* Software Icon Images. 2016.

Figure 26. *loopdiver* cast, Dance Center of Columbia College, Chicago, Photo By: Alexandra Matzke, 2010.

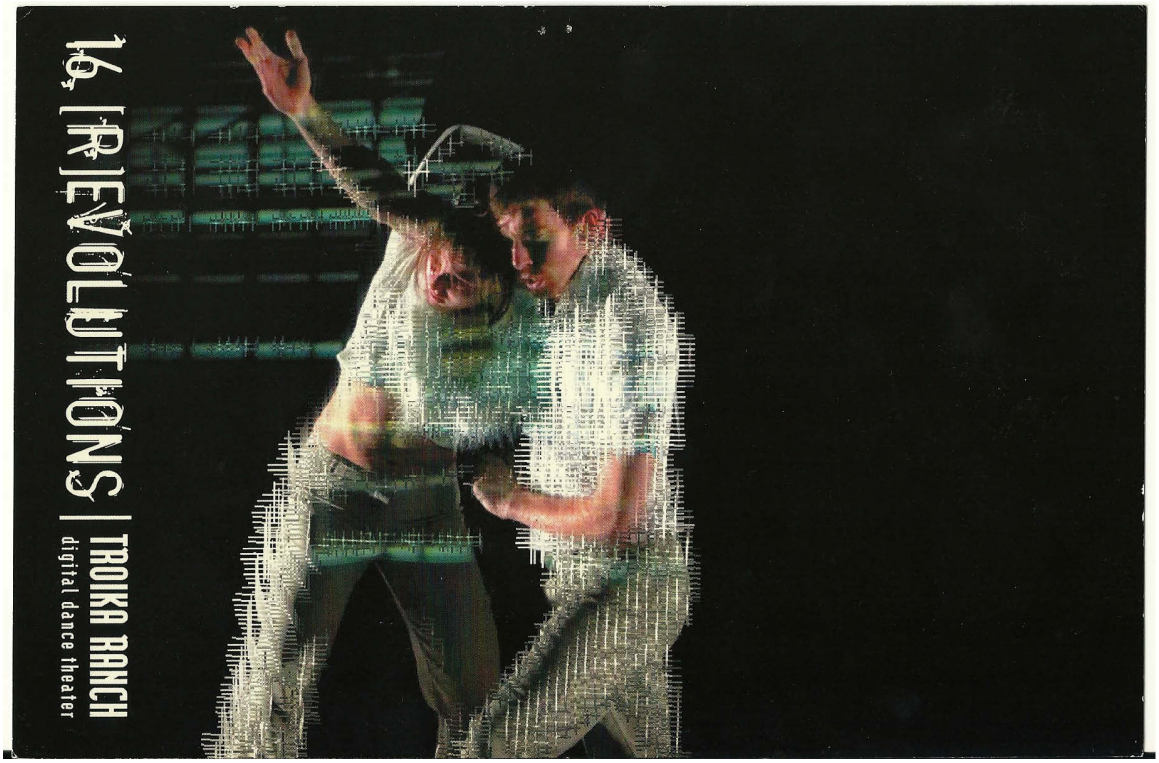


Figure 27. Troika Ranch. *16 [R]evolutions* Promotional Material. Eyebeam Art and Technology Center, New York, NY, 2006.

Figure 28. Dawn Stoppiello, Jennifer Kovacevich, and Travis Steele Sisk in *loopdiver*, Dance Center of Columbia College, Chicago, Photo By: Alexandra Matzke, 2010.

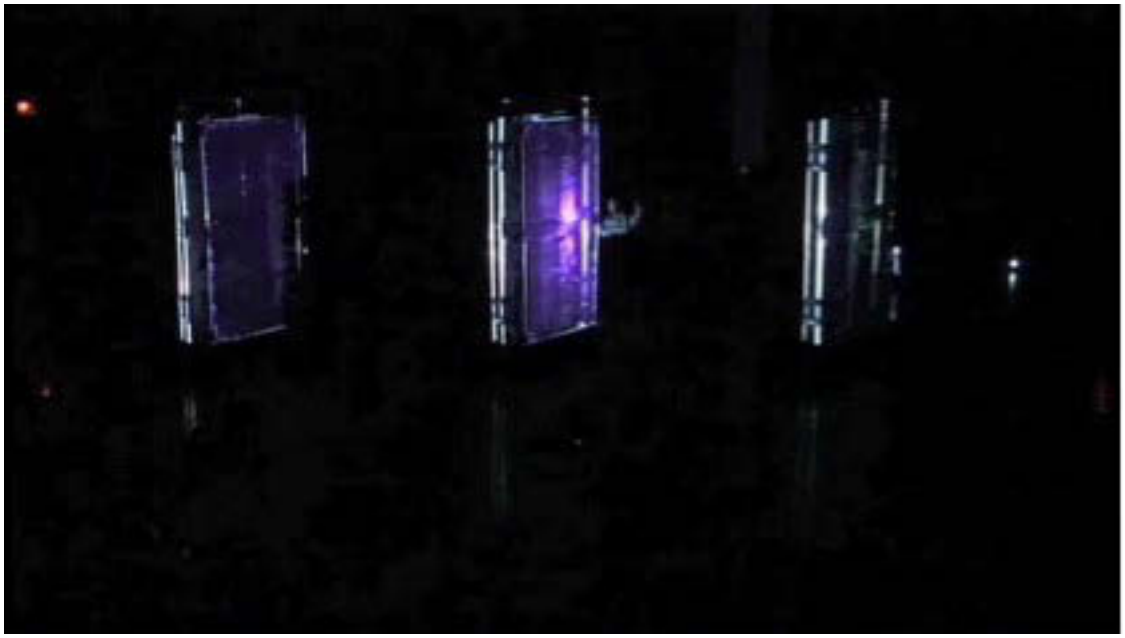


Figure 29. Screens in *loopdiver*, Dance Center of Columbia College, Chicago, Photo By: Alexandra Matzke, 2010.

Figure 30. *Swarm* at the Fenwick Theatre, Worcester, Massachusetts, November 15, 2015. Photo By: Eric Culver, 2015.

Figure 31. Dawn Stoppiello and Mark Coniglio at College of the Holy Cross for collaborative performance of *Swarm* at the Fenwick Theatre, Worcester, Massachusetts, November 15, 2015. Photo By: Tom Rettig, 2015.

Chapter 4: *Orbital Resonance:* Feminist STS Methods as Creative Practice in the Millennial Era

Figure 32. *Orbital Resonance*, Hexagram Blackbox, Concordia University, April 23, 2014, Photo by Nina Bouchard.

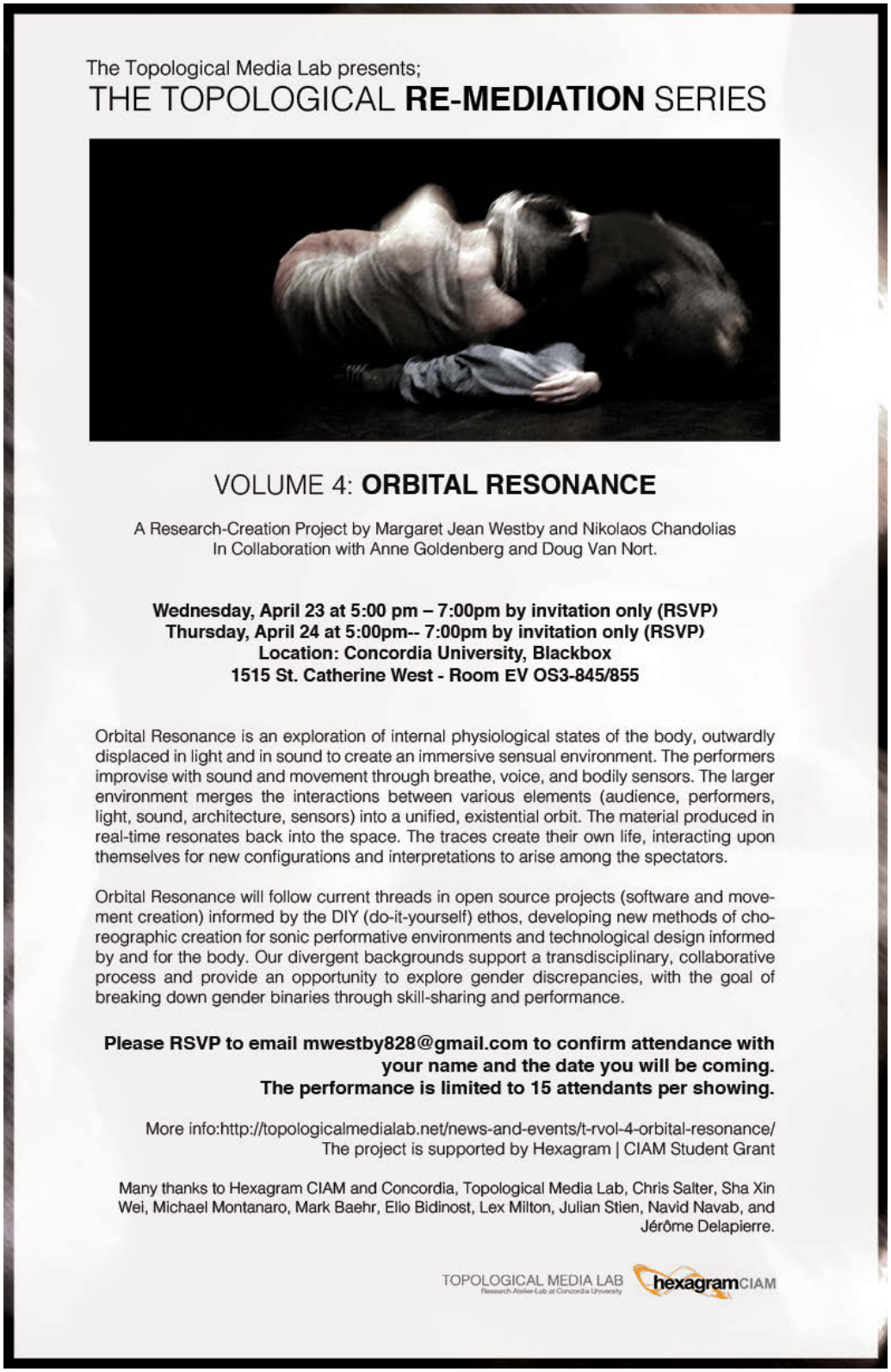


Figure 33. Public Announcement of *Orbital Resonance*. Flier by Nikolaos Chandolias, Nina Bouchard, and Margaret Jean Westby. April 2014.

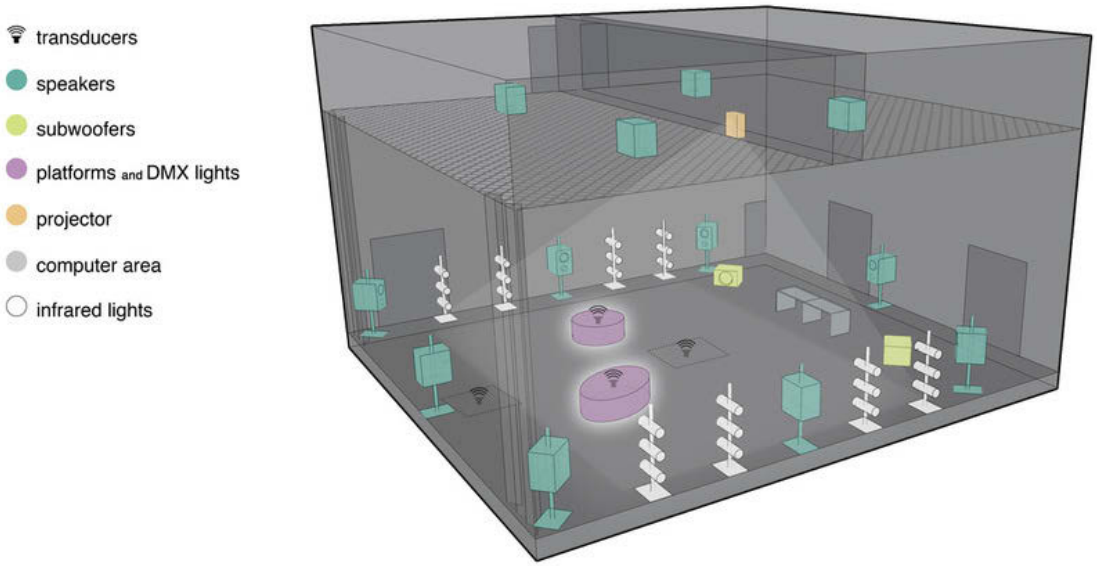


Figure 34. Diagram of *Orbital Resonance*. Created By: Nikolaos Chandolias, 2014.

Figure 35. Painting the wooden platforms used in performance, April 1, 2014, Photo by Nikolaos Chandolias.

Figure 36. Margaret Jean Westby and Anne Goldenberg. Rehearsal of *Orbital Resonance*, Hexagram Blackbox, Concordia University, April 16, 2014, Photo by Nina Bouchard.

Figure 37. Rehearsal of *Orbital Resonance*, Hexagram Blackbox, Concordia University, April 16, 2014, Photo by Nina Bouchard.

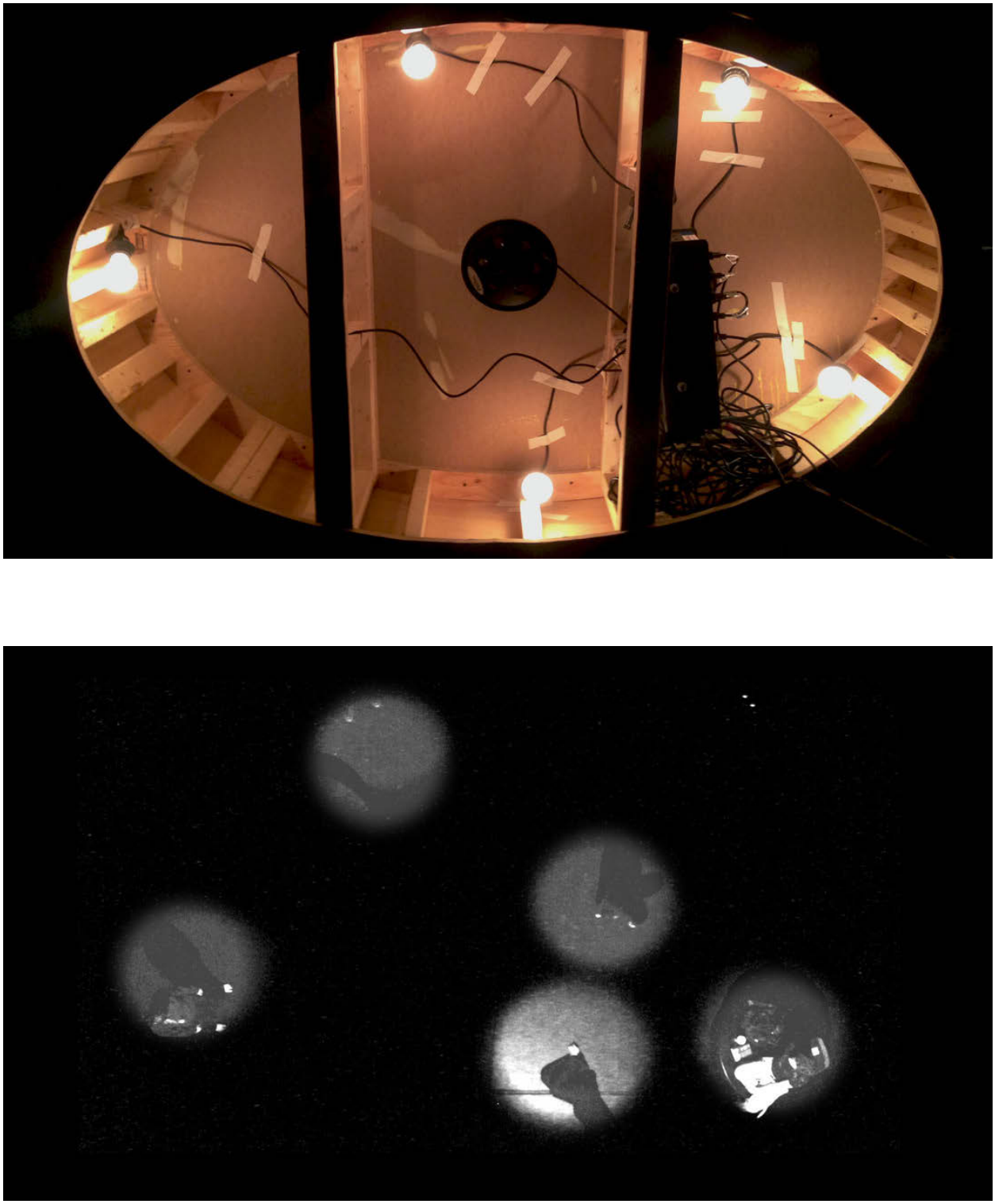


Figure 38. Rehearsal of *Orbital Resonance* (lights in wooden platforms and projected lights interactively programmed by *VVVV*), Hexagram Blackbox, Concordia University, April 16, 2014, Photo by Nikolaos Chandolias.

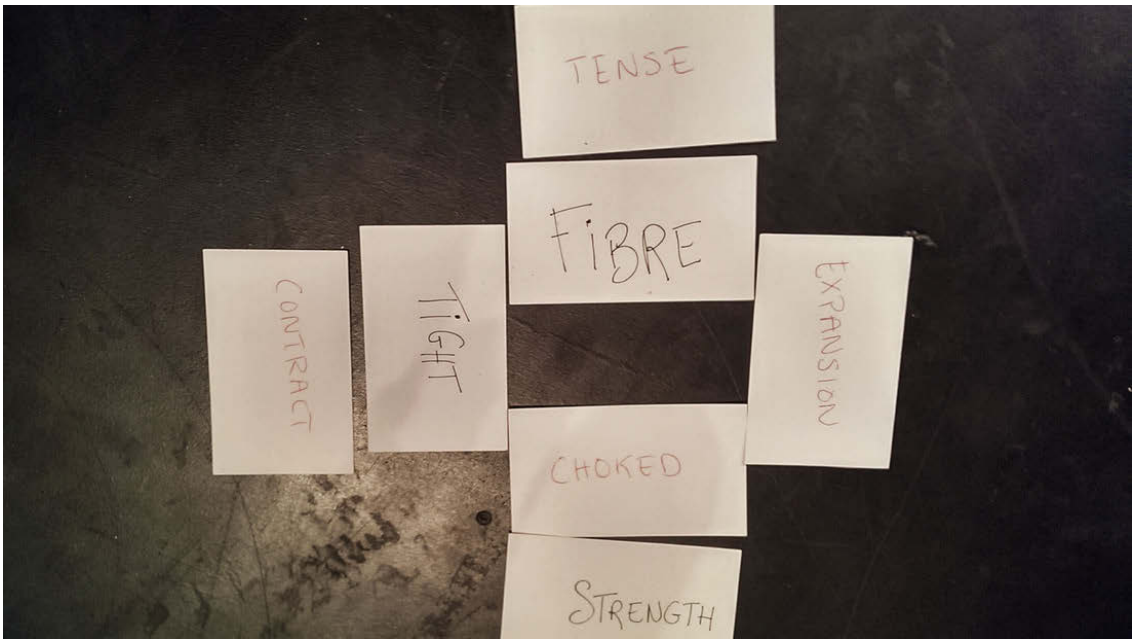


Figure 39. Rehearsal of *Orbital Resonance*, Hexagram Blackbox, Concordia University, April 16, 2014, Photo by Margaret Jean Westby.

Figure 40. *Orbital Resonance* Performance, Hexagram Blackbox, Concordia University, April 23, 2014, Photo by Nina Bouchard.