I'M NOT AN ASTRONAUT BUT I PLAY ONE ON TV

by

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Abstract

This thesis examines the artistic growth of the author, Dan Wilcox, over the course of his three year Master of Fine Arts at the Carnegie Mellon University School of Art. An artist with an engineering background, the author's practice is based upon the struggle and collaboration of three identities (the Artist, Engineer, & Musician) which guide his interest in artistic research, avant-garde performance, & electro-instrumentalism. Wilcox explains his philosophy that artists with his background should endeavor to include room for failure, misuse, criticality, and authenticity through their conceptual approach to technological media. He then examines his experimental work undertaken from 2010-2012 including a live "titty tracker", the literal translation of a poet's slippery mouth, and robotic wrestling matches pitting helpers versus hunters. Lastly, two multi-year-long projects taking place from 2012-2014 are presented: *Heading to Mars*, a book and exhibition compiled from experimental research while wearing a spacesuit in the Utah desert and *robotcowboy: Onward to Mars*, a one astronaut space rock opera about learning the music of the Red Planet.

In the end, Dan Wilcox may not be an astronaut but as an artist with an engineering and performance background, he can play one on TV.

Contents

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Russell Karloff for extensive proofreading

For my father Smith Wilcox 1938-2014

2nd Lieutenant United States Air Force, Aerospace & Systems Engineer

Yeah, Dad. I finished my thesis.

Portrait of the author as a toddler in a rocket garden

Infinity is the Language

all created art is music

art

choreography

sculpture

poetry

artworks

photographs

painting

architectural designs found in nature trees

flowers

grass

every thing's vibration is a different

degree of music

there is music everywhere

infinite infinity is the language of

enduring impression

- Sun Ra

Introduction

Art is the result of an allergic reaction to reality. - Los Carpinteros [1]

I am an an artist, engineer, musician, and performer who combines live musical performance techniques with experimental electronics and software for exploration of new expression, often through themes of science fiction, space travel, cyborgification, and far futurism. My father was an aerospace engineer, I grew up in the Rocket City (Huntsville AL), and have performed in Europe, Asia, and around the US with my one man band cyborg performance project, *robotcowboy*.

For three years, from 2010 to 2013, I attended the Master of Fine Arts program at Carnegie Mellon University. Coming from a largely technical background, I gained a great deal of personal insight into developing and maintaining a life-long art practice as well as getting in touch with my personal motivations. I was introduced to philosophy, art theory, and critical theory as well as questioning the role (and later my own role) of the artist in society. Before coming to CMU, I was largely working within the new media field without a conceptual base, acting upon instinct and intuition, and creating what I saw fit without rhyme or reason with some small success. After pursuing my MFA, I feel I have gained a refined focus and am in touch with both who I am artistically as well as the personal confidence to follow my interests and ideas into the future. This journey was not easy at times but, like any largely introspective process, has been ultimately rewarding.

This thesis examines my identity as an artist and fundamental artistic choices when creating work. It then presents and discusses selected experimental work undertaken from 2010 to 2012 and two larger subsequent projects in 2012-2014. By the conclusion of this paper, it is hoped that I have proven the development of my artistic practice.

Collaboration of Identities

> *Buckminster Fuller advanced the notion that the roles of scientist and artist have both evolved out of the tradition of the craftsman. That is to say, they both look inside to identify new questions and new ways to see things that nobody else can. - Richard L. Loveless in The Computer Revolution and the Arts [2]*

In 2002, I took a personality test. I was in the middle of an undergraduate "what the hell am I going to do with my life" spell and consequently struggling in school. The career office offered free testing to determine natural inclinations and interests and, lacking any better ideas, I decided to take one. This particular test, I forget what it was called[1], plotted its results on a circle with personality types arrayed along the edge. The test identifies three of these as main points which are used to determine correlated interests and careers. I was told the vast majority of results plotted these three points along one relative edge, showing a general connection. In my case, however, two were closer together with the third on the opposite side.

This came as a revelation: it was OK to be conflicted, to be interested in competing things. Simply having a note of confirmation after two years of bouncing between engineering to music to art to engineering again was helpful in determining how I was going to get out of college with some sort of plan. My computer engineering classes became a place to learn tools as opposed to a way of life, tools in which to pursue anachronism such as my growing love for both music and performance.

With my background in engineering and interest in performing, I recognize now that my artistic practice revolves around the collaboration of three identities: the Artist, the Engineer, and the Musician.

[1] Probably the Strong Interest Inventory which uses the Holland Occupational Themes (RIASEC)

- The **Artist** prefers the pursuit of uselessness, of engineered failure. He desires meaning, community, and context. Insight, observation, and an openness to serendipity lead to unexpected avenues.
- The **Engineer** works for efficiency, functionalism, design, and planning. He seeks a utopia of clean abstraction, where clarity and practicality rule the day. Mathematics, physical rules, electronics, and programming are tools of choice.
- The **Musician** plays by feel, works via improvisation, and expresses with direct energy through performance. Thinking is not needed when the instrument plays itself.

The **Engineer** provides my foundational skills, the **Artist** the conceptual thinking, and the **Musician** the live execution within my art practice. My work is not solely reliant on a single entity, but on their very combination.

R & D

> *Test failed, but success was not the goal - Daito Manabe*[2]

The **Artist** and the **Engineer**, as Fullerian craftsmen, conduct what Lieberman calls "Research & Development for Humanity" [3] where experimentation and iteration are an important aspect of the working process. As art historian Katja Kwastek states, the **Artist** is not necessarily concerned with the end result of creating a work of interactive art but in the the arrangement of processes that lead to it. Although many see these roles as fundamentally different, for her this approach approximates that of engineers and designers which leads towards a natural area of artistic research:

> *… in many cases the choreographed processes are not the means to an external end of insight, but rather the theme of the works. In this way, artists conduct fundamental research comparable to scientific practice. [4]*

[2]Statement in a presentation by Daito at the OpenFrameworks Developer Conference at Carnegie Mellon University in Jan 2011

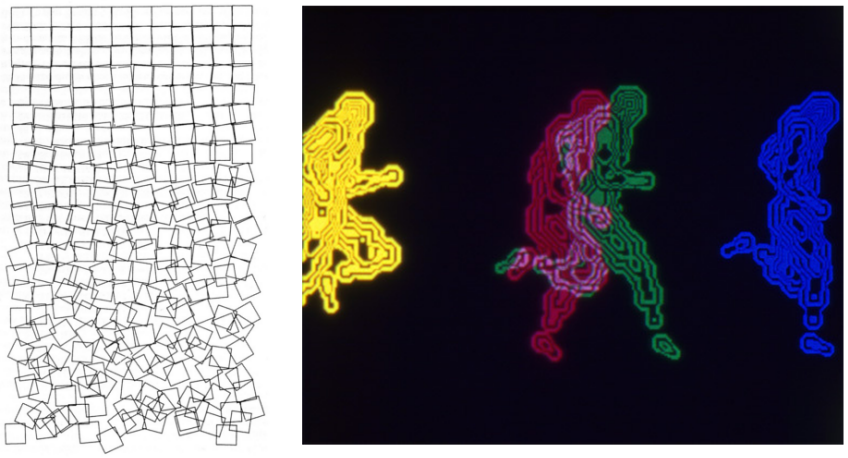


Figure 2.1: (left) *Schotter* Georg Nees 1969 (right) *Olympiad* Lillian Schwartz 1971

The **Engineer** brings skills and processes to the table which are balanced by the **Artist** who often sees screw-ups and inefficiencies as necessary and sometimes desirable. Bugs become features and an over thought out plan gives way to experimentation built upon serendipity and iteration. Prototyping allows flexibility of ideas while utilizing a balanced technical skill set with emphasis on exploration as opposed to production, the lab as opposed to the factory.

This collaboration is influenced by new media artists & practitioners who work in a similar vein, the open source movement, and arts engineering toolkits. Since the 60s, artists have endeavored to explore the use of computation as applied to creative work. From Georg Nees' plotter drawings and Lillian Schwartz's generative video work done during after hours at Bell Labs (Figure 2.1), artists have shown that they are both excited and willing to explore new media under development. These artists approached computation from an artistic background and enlisted the help of engineers and computer programmers at a time when access to mainframes was limited to large institutions.

Similarly, artist and researcher Myron Kruger is credited as originating "interactive art" and interactivity based on computer vision through his pioneering *Videoplace* starting in the mid 1970s. Playing off Marshall McLuhan's famous "the medium is message", Kruger took this one step further with "the response is the medium" by focusing beyond the presentation to the actual human computer interaction, long before HCI programs even existed. Largely unsung for many years, Kruger's work heralded body-based human

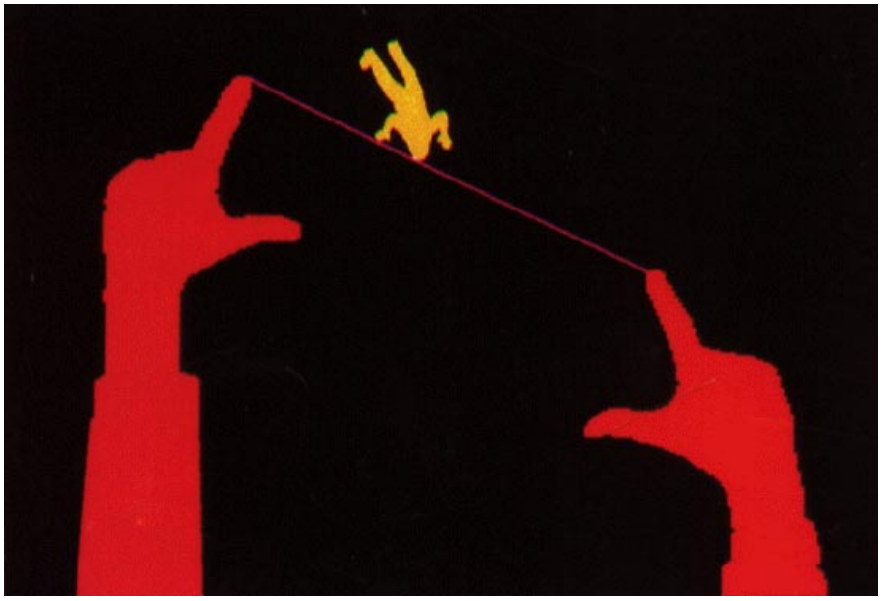


Figure 2.2: *Videoplace* Myron Krueger

computer interaction and feedback which are now the basic building blocks for robotics, HCI, and interactive art works. In this case, the artist developed the ideas before the engineers. Thus, in new media, art & engineering work hand in hand. (Figure 2.2)

Building upon Kruger and his contemporaries, Golan Levin & Zachary Lieberman demonstrate the continued application of traditionally engineering-oriented computer vision techniques towards a new poetic exploration of expression and feedback between users and interactive systems. Often times, these works use algorithms and mathematics derived from technical and research papers but applied to a more artistic aim with the much more powerful and ubiquitous computational hardware of the 2000s. As the group "Tmema", Levin & Lieberman's 2003 *Messa di Voce*, for instance, utilizes computer vision, sound analysis, and generative processes to project a live augmented environment around virtuoso vocalists Jaap Blonk and Joan La Barbara (Figure 2.3). This piece and much of the work of both Levin and Lieberman have become touchstones for both contemporary media art and human computer interaction, clearly blending the lines between computer science, research, and visual art:

> *Messa di Voce lies at an intersection of human and technological performance extremes, melding the unpredictable spontaneity and extended vocal techniques of human improvisers with*

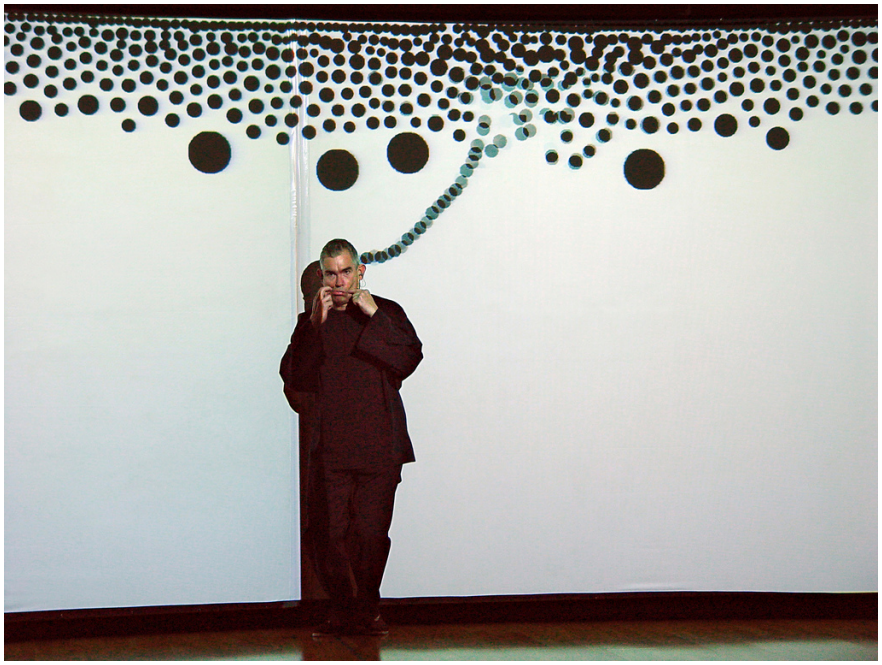


Figure 2.3: Japp Blonk performs in *Messa di Voce* by Tmema (Golan Levin & Zachary Lieberman) 2003

> *the latest in computer vision and speech analysis technologies. Utterly wordless, yet profoundly verbal, Messa di Voce is designed to provoke questions about the meaning and effects of speech sounds, speech acts, and the immersive environment of language. [5]*

Around the same time, artists working with technology began developing and sharing their own tools for both collaboration and increasing accessibility for artists without a technical background. Open source creative engineering software frameworks such as Processing, OpenFrameworks, & Pure Data have expanded the accessibility of computation for the arts through community driven work. Through largely experiential and iterative development, these new tools are tested and grown as more artists and students become practitioners, giving back in the spirit of open collaboration between artists and engineers: DIWO or “Do It With Others”.

Coming from an engineering background and delving into art & music, I was exposed to new media and artists working with technology as a medium in the mid 2000s, including Golan Levin & Zachary Lieberman. This revelation legitimized my interest in employing engineering skills for non-engineering results and inspired my continued interest at the time to work for Ars Electronica, which since 1979 hosts the foremost electronic art festival in the world in Linz, Austria. Working for the Ars Electronica Futurelab put me in

contact with numerous media artists and musicians as well as approaching large scale creative projects in the European art & technology scene. This experience inspired my interest in pursuing my artistic practice.

Avant-garde Performance

> *It is a sign of foolish naïveté, joy in procreation and preoccupation with the baby carriage. - Hugo Ball on the usage of the word "Dada" [6, p. 62]*

The **Artist** and the **Musician** develop a humor and performance aesthetic based on the "avant-garde", literally an "advance force" pushing into new and possibly dangerous territory. This collaboration is interested in creating art which is largely not yet perceived as such, having no institutional place within institutions. The outcome is a visual design and performance aesthetic built upon a conceptual base, even if this base may not be completely transparent to the audience.

The **Artist** is drawn to the tearing down of the status quo as outlined by the avant-garde artists of the early 20th century where Andre Breton's "simplest surrealist act" is to fire a pistol randomly into the crowd [7]. The Dadaists of the Cabaret Voltaire wrought art which fundamentally played with media, shaping and forming new forms of expression for the modern industrialized age. This cutting edge experimentation worked against the grain of romantic art as the ultimate "anti-art", a self-intended failure where "success was not the goal" and themes were explored through humor and meaninglessness.

Similarly, the **Musician** is influenced by punk and postpunk[3] thought, of the combination of the DIY (Do-It-Yourself), melding of avant-garde and pop, and the mistrust of institutionalization. The loud, fast music and explosive energy of a live underground show carries with it a mix of both popular and avant-garde[4]. The arts and music have a traditional bond and most postpunk bands consisted of art school musicians, from DEVO to the Talking Heads (Figure 2.4), directly influenced by the early moderns and the avant-garde:

[3]Postpunk: 1978 - 1984, New Wave, No Wave, etc

[4]At this point, however, it can be argued that many subcultures have become reified versions of their original intentions, punk included.

Figure 2.4: Members of Talking Heads wearing digital masks on the album cover for *Remain in Light* 1980

> *The entire postpunk period looks like an attempt to replay virtually every major modernist theme and technique via the medium of pop music. Cabaret Voltaire borrowed their name from Dada. Pere Ubu took theirs from Alfred Jarry. Talking Heads turned a Hugo Ball sound poem into a tribal-disco dance track. Gang of Four, inspired by Brecht and Godard's alienation effects, tried to deconstruct rock even as they rocked hard. [8, p. 2]*

Further, Karen Pinkus states the frantic Do-It-Yourself style, rebelliousness against convention, and distaste for the old/love of the new in the punk subculture is related to the Italian avant-garde Futurist movement, where "forward motion and speed are in opposition to 'armchairism' " i.e. the "the home-bound bourgeois patron of the fine arts." [9]

Fiercely independent, the **Musician** finds himself working against the perceived institution of the "Art World". Underground rock and punk are, in some ways, an enclave of "the anti-intellectual intellectual"

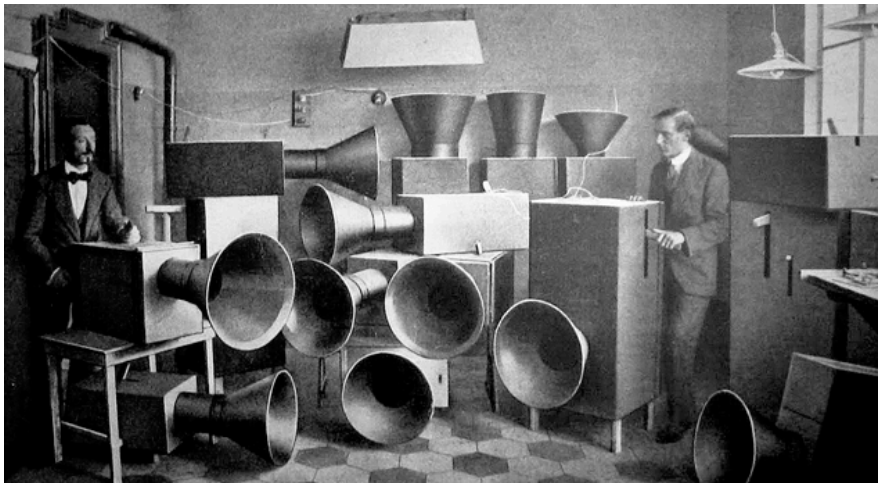


Figure 2.5: Futurist Luigi Russolo & assistant with *Intonarumori* "noise machines" 1914

who is "ravenously well read but scornful of academia and suspicious of art in its institutionalized forms." But as Reynolds points out, "what could be more arty then wanting to destroy art, to smash the boundaries that keep it sealed off from everyday life?" [8, p. 2] The **Musician** and **Artist** perhaps struggle toward the same goal, where rock music itself is used as a medium for simultaneous intellectualism and accessibility:

> *… and that's one of the great things about rock music. You don't have to be thrusting your intelligence into people's faces all the time. If you're really smart you know when it's appropriate to be dumb. - Rowland S. Howland of the band The Birthday Party [8, p. 358]*

The **Musician** combines this accessible and confrontational approach to performance with the conceptual background of the **Artist** to provide a unified message and aesthetic approach to performance as pioneered by the avant-garde and early modernists. Futurism's advocation for a full embrace of new technology over the prevailing romanticism of the time extended beyond traditional media into dance and musical instrumentation. For the Futurists, humans must "surpass muscular possibilities" in order to become like a machine: the dancer in the *Dance of the Machine Gun*, on all fours, was to "imitate the form of the machine gun … her arm raised in front … like a barrel." [10] Luigi Russolo's 1917 Futurist *L'Arte dei rumori (The Art of Noises)* manifesto declared that the noise of mechanized life had become a new modern music, that all sound was possible material, and new instruments (Figure 2.5) should be built to play these new tonalities:

Figure 2.6: Actors pose in costume for Oskar Schlemmer's *Triadic Ballet* in Berlin 1926

> *Beethoven and Wagner have shaken our nerves and hearts for many years. Now we are satisfied by them, and we take greater pleasure in ideally combining the noises of trams, explosions of motors, trains, and shouting crowds than in listening again, for example, to the Eroica or the Pastorale. [11]*

Following Futurism, Bauhaus influences the **Artist** to advocate a "Formalist" approach to the avant-garde where the clean lines and functional economy of the machine age are used to transform everyday life. Walter Gropius foresaw a "total art" where all aspects of artistic production were combined through a serious, professional approach; artists not as embellishment, but designers and architects for an integrated future. Oskar Schlemmer's *Triadic Ballet* utilized bold graphic design, constrained costumes, and rigorous training in order to turn dancers into the machines and elements they portrayed (Figure 2.6). Consequently, the **Artist** and **Musician** develop a performance aesthetic that is optimized for simple, bold designs and movements where the elements of the performance are directly related to sound and vision.

A case-in-point for the mix between pop and the avant-garde, DEVO, the band of de-evolution, is a large influence on the collaboration of the **Artist** and the **Musician** (Figure 2.7). Originating in the 70s, DEVO is a tight multimedia band utilizing film for live performances and a carefully constructed lobrow/hibrow sci-fi pop culture aesthetic literally "out of sync" with the status quo, "a musical laxative for a constipated

Figure 2.7: DEVO *Freedom of Choice* album promotional image 1980

society". They pioneered the music video as an integral part of their multimedia oeuvre during a time when videos were short films meant to sell a soundtrack. Recognizing the medium as a place at the crossroads between the avant-garde and consumer advertising, DEVO utilizes its postmodern pastiche and imagery. By borrowing from the popular language of film through the music video aesthetic, the band is able to speak clearly to their audience while at the same time maintaining control of their message:

> *Early Devo was a child of dada, the theater of the absurd, the blackest of black humor and rabid political backlash against the Establishment. People were pissed off, and early Devo is full of political anger and comment: My Lai Mama, I Been Refused, All of Us, Auto Mowdown. The songs not only presented a hunkered down aesthetic, but they were political songs in quite specific ways. - Bob Lewis, member of DEVO*

Over time they morphed into a tight pop band with an emphasis on disseminating their critique on society by "applying deevolutionary analysis to music and commercial media" [12]. Smith states that the music video was integral to their artistic development and their amalgamation of music, design, and video, ranks them, if not the first, one of the first multi-media bands. After signing to a major record label, they proceeded to work against corporate convention from the inside, perpetually "out of sync" with mainstream society.

Figure 2.8: Still from *Home of the Brave* Laurie Anderson 1986

In a similar vein, performance artist Laurie Anderson has consistently shown that the avant-garde edge of art and music is closer in pop than it is in visual art/performance. As a performer and storyteller, she is able to walk a wider line and speak to a broader audience through pop music rather than pop art. Anderson provides a simultaneous mix of social commentary, aesthetics, and entertainment through thematic costumes, imagery, and songs (Figure 2.8). She and DEVO are two examples of performance artists and musicians who have a deep and coherent message in their work which greatly increases its impact. She is able to successfully mix songs influenced by philosophy and social commentary with pop music and wants the viewer to pay attention to the way "things pull at each other" [13, p. 17]. Similarly, DEVO strives to "create a universe of discourse that would be both an aesthetic capable of critical analysis and a tool for social justice." [12]

Along this line, the **Artist** and **Musician** seek to produce performances that sit within that grey area of both pop and avant-garde through aesthetics and story, all the while keeping a rebellious spirit in the forefront. My work is not made purely for aesthetic exploration or execution of skill but for research and social interest, as related to the section on Research & Development. This approach, however, is focused beyond what Medosch terms simply "the contemporary"[5] in the current post-postmodern era [14] toward

[5]Medosch in *The Future of Memory - the Contemporary in a cul-de-sac*: "The contemporary has thus internalized - even if this

an investigation into work which is meant to bring discussion to a larger audience, in the manner of Devo touting “de-evolution” or Laurie Anderson examining modern life through performance and spoken word. I look toward the future with optimism, but not, I hope, with a naiveté towards media or the world they are currently shaping.

Electro-instrumentalism

> *[E]ach musician makes his own instrument to suit his own particular tastes. He also teaches the instrument the language it will speak which is, of course, the musicians own mother tongue. - Francis Bebey in African Music: A People’s Art [15]*

The **Musician** and **Engineer** create systems for composition and performance using custom instrumentation and computer software. The studied approach of the **Musician** to the instrument is combined with the tool making and process design of the **Engineer**, where Youngblood holds that the “nonstandard personal visions” that drive the **Musician** (here an amateur in the classical sense[6]) “require the invention of new techniques or technologies” much akin to the tradition of the folk instrument:

> *… the artist-amateur makes a deep commitment to an instrument - building it, living with it and through it, plotting a life’s course with it. … The amateurs relation to tools is primarily ontological rather then commercial or even aesthetic: it’s a kind of practical philosophy or personal discipline, a way of life, a way of being in the world and a way of creating a world to be in. [16, p. 11]*

aspect is sometimes less apparent - institutional critique and a critical questioning attitude. This results in an artistic language which often uses several layers at the same time and uses montage on a meta-layer, by bringing conflicting systems of meaning into contact with each other.” [14]

[6]Youngblood continues: “Surely no motivation is purer, no achievement more dignified than that of the amateur who does it for love. (The word”amateur” is derived from the Latin amare, ‘to love.’) Yet in our professionalized society this most noble aspiration has been reduced to a sneering joke - the amateur as some kind of bozo - as though doing it for love were synonymous with ineptitude, an absence of quality and value.”

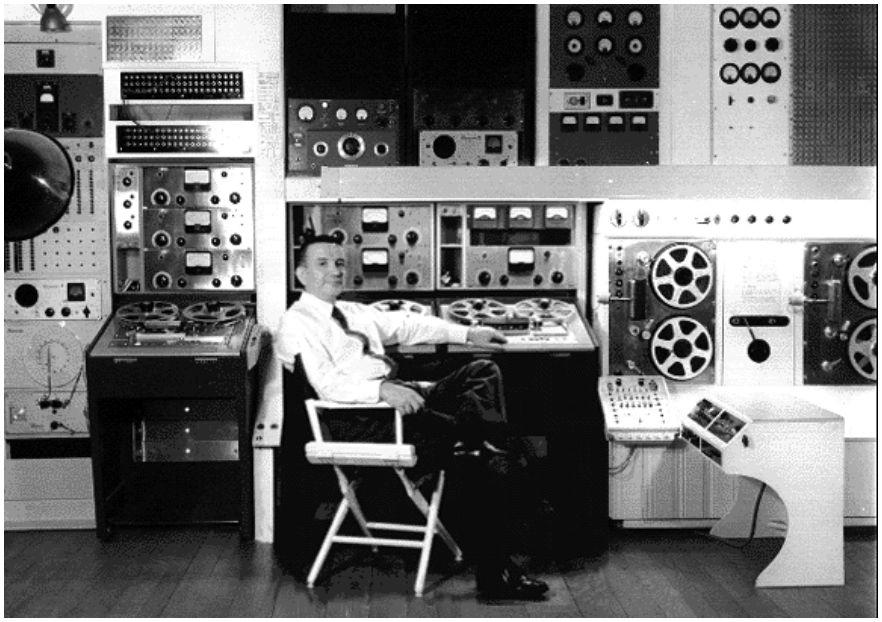


Figure 2.9: Raymond Scott in his Manhattan Research Inc. electronic music studio circa 1960s

By creating their own instruments, the **Musician** and the **Engineer** endeavor to both explore new approaches to performance as well as create a more personal work. Western music tradition has largely standardized instrumentation, tuning systems, and timbre, eschewing the notion of the instrument "as an entity that carries its own context and distinction". Instruments in African musical culture, however, are "built based on need, availability of construction materials, and the experience of the builder" [17, p. 26]. Working with technology directly in the same manner, the **Engineer** is the craftsman building a personalized instrument for the **Musician** and this process of "tool making" is part of a compositional workflow which largely informs the resulting performance.

This collaboration is influenced by musicians & composers who utilized technology to expand their own instrumentation. Best known as the band leader behind 1940s Looney Toons cartoon music, Raymond Scott went on to build one of the most advanced studios in the 50s, Manhattan Research Inc, in order to produce electronic advertising jingles (Figure 2.9). The maverick Scott taught himself electronics and built his own instruments, all the while maintaining the same approach he had while working with live musicians. Some of his more famous sounds were produced by his *Circle Machine*, an electro-mechanical rotatory sequencer utilizing lightbulbs and a spinning photocell, as well the *Clavivox* and *Electronium* syn-

thesizers, both of which were notoriously temperamental and could not be controlled, but "guided". The indeterminate nature of these machines mixed with live recording experience imbues his electronic music with an energy and liveness not found in that of his contemporaries.

Classically trained composer and performer David Tudor collaborated with John Cage, synthesizer pioneer Bob Moog, renowned dancer Merce Cunningham, and others in the 1960s on experimental performances bridging art and technology. Although he did not have a technical background, Tudor nevertheless "got his hands dirty" building tools and electronic circuits as part of the compositional process. At the same time, fellow composer Gordon Mumma experimented with electronics and built his own augmented instruments in order to expand their sonic possibilities. His *Cybersonics* movement stemmed from the desire to move beyond the existing limitations of his practice without sacrificing the expressivity inherent in classic instruments. Mumma's tool-making created a hybridity of the classical and the avant-garde which, like Tudor, shared an aesthetic of wires and handmade electronics.

A return to this DIY hacking mentality offers exploration of sound and content through direct interaction and "composing within the electronics", whether it be through circuit-bending, digital guitar augmentation, or software "patching" in unstructred enironments such as Pure Data[7] (Figure 2.10). This exploratory approach towards music making allows the **Musician** to step back from conventional composition and began experimenting with algorithmic processes, machine music, and generative accompaniment with the **Engineer**. Improvisation replaces strict notational playback allowing for a whole new area of feedback and engagement with the medium and experience itself. Through play, the **Musician** and the **Engineer** are able to create and practice new modes of expression. Building custom music-making software frees this collaboration of identities from the limitation of someone else's concept of composition and performance by "starting from scratch". If new ground is to be broken in my musical journey, then the tools must match the job.

[7] An open source graphical programming environment for multimedia: http://puredata.info. Signal processing is built by creating objects which are connected by metaphorical wires which, for me, is like building a virtual modular synthesizer.

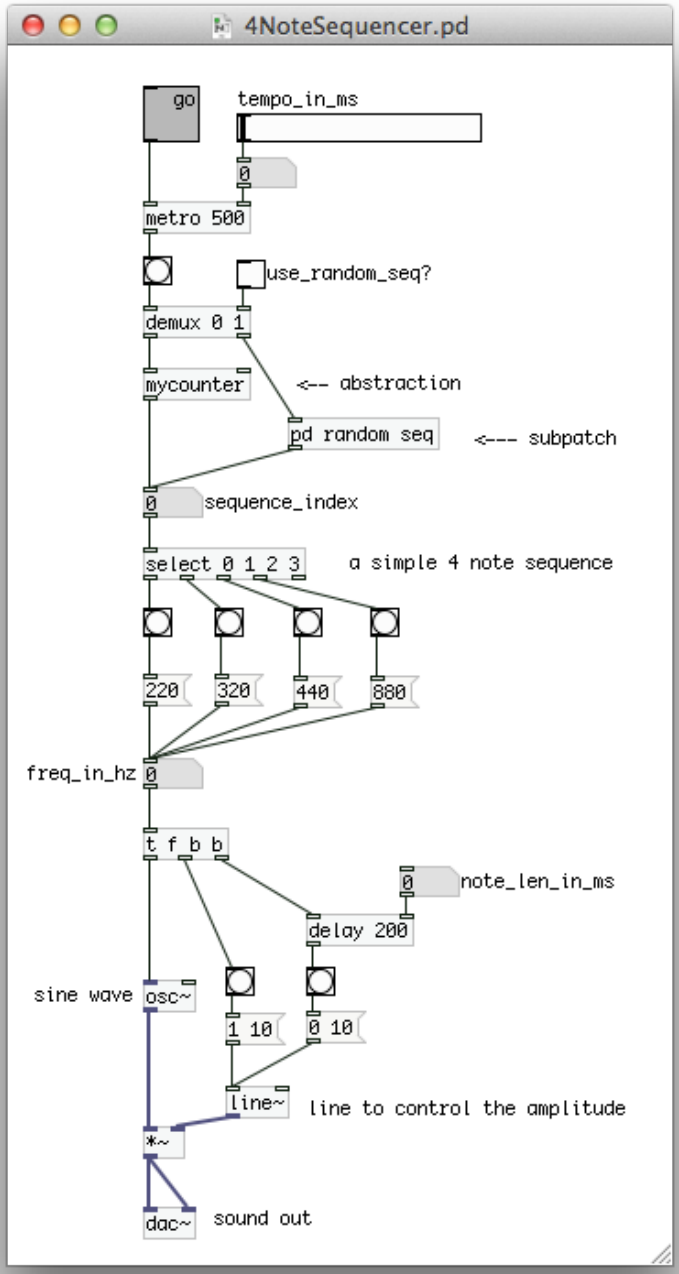


Figure 2.10: Pure Data graphical programming “patch”: a 4 note sequencer

Choices

As is the case with many things, the whole is more than the sum of its parts, or more likely, the combination of competing and collaborating interests. My artistic approach involves my relationship with technology as a medium and I thrive by imposing creative constraints which help limit the inherent limitlessness of electronics and software. These choices coupled with a focus on performance lead to an artistic practice both reliant on and distrustful of the very technology I use. As I develop my artistic insight and approach, I come to appreciate the collaboration of identities and have discerned three common themes in my approach to creating work: there must be room for failure, the (mis)use of technology, and authenticity through action.

There Must Be Room to Fail

> *Fix it Mode is probably the mode the machine is in most of the time. - Benthall on Nicholas Negroponte's SEEK 1972 [18]*

Negroponte's 1970 *SEEK* was a pioneering piece of computer art complicated by gerbils. A computer-controlled robot arm built an environment out of wooden blocks through which its denizens scampered and hopped, modifying as they went (Figure 3.1). Unable to keep up with these unpredictable alterations, the computer spent most of its time trying adapt and "fix" the landscape. The technology was a metaphor to a cold, calculating authority forever behind in trying to achieve a notion of utopia for its irrational citizens. This *failure* is central to the piece. Technically, everything is executed perfectly, but nobody told the gerbils to follow the script. [18]

When I create, I don't follow a script. When I perform, I expect the script to run off the rails. These failures, as the cliche goes, are opportunities for new insight. The problem-solving **Engineer** looks for ways to eliminate failure, while the **Artist** makes sure there's always a chance it may happen. An example of this mix is mechanical sculptor Jean Tinguely whose work can best be described as anachronistic nonsense

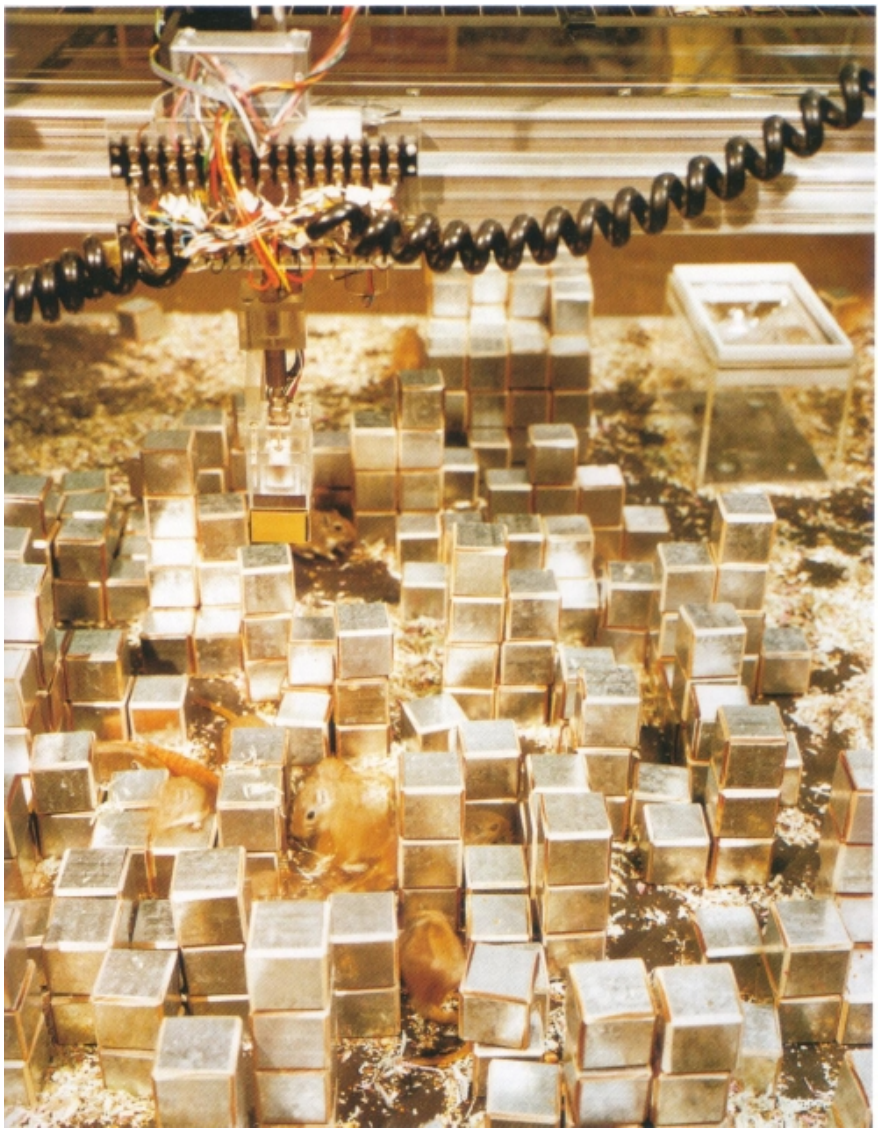


Figure 3.1: *SEEK* Nicholas Negroponte 1970

Figure 3.2: *Rotozaza* Jean Tinguely 1967

Figure 3.3: (left) Litton RX2A Apollo hardsuit prototype favored by NASA 1965 (right) Apollo A7L Thermal Micrometeoroid Garment layer on the ILC assembly line

machines which, despite their appearance and (non)function, required a great deal of skill to construct (Figure 3.2). There can be virtue in bad engineering:

> *Tinguely is refreshingly unpompous and witty. For instance, his Rotozaza (1967) is a social parable: an elaborate machine, making a virtue out of bad engineering like most of his work, whose output (rubber balls) has to be blended back into it by the spectators. [18]*

Artists working with technology must recognize and celebrate the fact that our medium is *not* utopic in nature, we are still at the point where rigidly engineered solutions do always not fit with the inherent squishiness and frailty of human life. To many, NASA's Apollo program represents one of the pinnacles of engineering achievement, yet the development of the Apollo A7L space suit relied on the improvisation and imprecision of hand sewn materials used in its design by the International Latex Corporation (nee Playtex). The competing "hard suit" prototypes, while icons of design and engineering, were simply less maneuverable and comfortable to wear than the ILC prototype which relied on the expertise of a company used to adapting to the requirements of the human body when making corsets and brasseries (Figure 3.3). This point was made clear via a 1967 16 mm film of an ILC employee playing football in a prototype A7LB, eschewing the usual technical motion studies (Figure 3.4). In the end, the utopic, engineered ideal lost out to the "messy" yet somehow more satisfying and "human" A7L:

> *When we examine the history of the spacesuit, we find a discourse that migrated protection and stiffness towards softness and contamination. [19]*

Figure 3.4: ILC employee playing football in an Apollo A7L prototype 1968

An element of failure must be present for all of my pieces or, at the very least, include the human into the process to allow for irrationality and spontaneity. The utopia of the constructed systems of the **Engineer** must give way, in some respect, to the chaotic nature of the **Musician**. I will always build my systems and performances in this manner to ensure that I can screw up … and then practice so I won't. There must always be a chance for the unexpected, whether malfunction or not, which provides an arena for improvisation and unpredictable interaction: a utopia of anticipated failure and unending opportunity.

(Mis)Use of Technology

> *Otto Piene the kinetic artist has recently proposed that nuclear bombs should be exploded as fireworks in outer space. - Benthall 1972*

Technology is becoming (or has become) more and more dominant in media today. The zeitgeist of our

times is in the assimilation of content and identity in the online world where everything is mediated through computers, networks, and information design. Following McLuhan's famous maxim "the medium is the message", this mediation through technology affects how we relate to each other and see the world.

Working with software & electronics, I recognize how this medium influences creation. My approach to writing software, working with music & sound, and my presentation and aesthetics are, in some part, derived from an engineering background. As a digital artist, the **Artist** and **Musician** must constantly balance the **Engineer** in order to achieve purpose in the work, otherwise it is meaningless. The medium itself is nigh limitless in possibility, yet this freedom can easily become a black hole gobbling up effort and ideas:

> *I … found that programming is an absorbing, mind-intensive activity; throughout my entire programming career I have always had to remind myself to stay aware of the purposes for my involvement in it. It's easy to get engrossed in coding general problem-solving tasks and forget to make art. Computers are so enticing that it's easy just to play with them for hours and hours. - Duane Palyka 1989 [20]*

As Tinguely "seems both fascinated and repelled by machines" [18, p. 110], I have a love-hate relationship with technology which becomes the basis for its misuse and re-appropriation. The medium can be manipulated reflexively in an absurd, humorous, and self-serious manner in order to highlight general assumptions and failures. As artists working in tech, we should strive to utilize our tools in radical ways towards applications never envisioned by their creators thereby gaining control of and/or subverting existing systems and schools of thought. As Douglas Rushkoff states: "program or be programmed."

For example, *FaceFlip* by Max Hawkins in 2010 is an art intervention staged in the then-popular video-based social networking website ChatRoulette. Normally, the service selects and displays a random person's video feed. Hawkins' software, however, breaks this convention and creates an unexpected interaction by manipulating the user's own realtime image (Figure 3.5):

Figure 3.5: *FaceFlip* inverts faces in ChatRoulette user video, Max Hawkins 2010

Figure 3.6: *FriendFlop* swaps user avatars & names on Twitter and Facebook 2013

> *Instead of seeing a randomly-selected person on the screen as the service intends, FaceFlip's unwitting participants see a modified mirror image of themselves with a surprising modification - their face has been inverted using a computer vision algorithm. [21]*

The similarly named 2013 *FriendFlop* by Kyle McDonald & Lauren McCarthy is a Google Chrome web browser plugin that randomly shuffles avatar pictures and names when viewing your Twitter feed or Facebook timeline (Figure 3.6). This simple action critiques the tendency for the contemporary flood of self-selected social media information to reach a repetitive sameness and attempts to help you in "dissolving your biases and reminding you that everyone is saying the same shit anyway." [22]

Although playful in nature, both *FaceFlip* and *FriendFlop* were developed by artists in order to subvert the very systems they are utilizing. This approach leads to a criticality beyond work by example, i.e. the artist's point of view, since its essentially interactive nature brings the viewer's own experience to the forefront. By presenting our own preferences and expectations in new ways through interactive software, the artists help us open up to "pulling back the curtain" on our own usage of social media, in this case, and societally-shaping technologies in a larger sense. It's up today's artists to utilize the language of software,

engineering, and technology in order to find new areas of expression and criticality:

0. *The Critical Engineer considers Engineering to be the most transformative language of our time, shaping the way we move, communicate and think. It is the work of the Critical Engineer to study and exploit this language, exposing its influence. - The Critical Engineering Manifesto 2011 [23]*

Authenticity Through Action

I know it when I see it. - Justice Potter Stewart's 1964 ruling on the nature of pornography

Authenticity in performance is paramount. The performer must stay true to their expression and freedom of action through embodiment, gesture, and liveness. The commodity of my work is not video documentation or musical recordings, but the experience of the moment itself. Live performance is one of the mediums of expression where the Benjaminian "aura" holds true: to witness something live is to experience whereas reproductions only hold vestigial memory.

Dutch experimental electronic musician, Michael Waisviz, considered the godfather of circuit bending, wanted to dip his hands into electric sound (Figure 3.7). He took his custom electronic creations to the stage in the early 70s and later became a founding member of the Studio for Electro Instrumental Music (STEIM) in Amsterdam. Throughout his life, he emphasized the use of gesture in music through technology and held the live act of bodily performance higher then that of the recorded, making very few recordings of his improvisations.

I create systems for performance as opposed to playback or "interaction" in a purely installation art sense. They feature instrumental feedback and rely on the embodiment of the computation through corresponding movement and gesture. A small action yields a small response, a large action brings a large response, and effort is made to provide a matching visual "cue" for the audience to understand the connection between performer and machine. Pressing a piano key produces an obvious note, pressing a mouse button could cause anything to happen so I attempt to codify or pair down this expanse.

Figure 3.7: "… dit is uw leraar …" ("…this is your teacher…") Michel Wasiviz 1972/73

Figure 3.8: Atau Tanaka performing via EMG forearm sensors at STEIM 2007

In the early 90s, performer and new media artist Atau Tanaka began experimenting with his own muscle signals as a source of both sound control and generation through the EMG (Electromyography) sensor-based Biomuse system. By moving his arms and clenching his fists he was is able to manipulate sound without an apparent instrument, much like Leon Theremin before him (Figure 3.8). At STEIM in Amsterdam, Tanaka collaborated with Edwin van der Heide and Zbigniew Karkowski in Sensorband, a group that worked to "reconcile new technology with the immediacy and energy of a rock group". Tanaka played the "guitar-bass" with EKG, van der Heide "vocals" via ultrasonic hand sensors and digital sampler, and Karkowski "drums" in a cage armed with infrared beams.

Together they created the 11x11 meter hanging *Sensornet*, an instrument played by all three performers simultaneously triggering sound as they climb upon it (Figure 3.9). The motivation behind such a large controller was to expand beyond the tiny motions of computer mouse and keyboard through a hyperbolic increase in gestural size:

> *We are creating music with interactive technology, but the technology part is tiny compared to the physical part. The rope, the metal, and the humans climbing it take on an incredible physicality, and focus more on the organic nature and the human element of interaction rather than on mouseclicks and screen redraws. [24]*

Following the DIY approach, John Richards argues that interface design was also affected by the post-digital. Digital input devices, such as a trackpad or keyboard, generally have a small degree of gestural

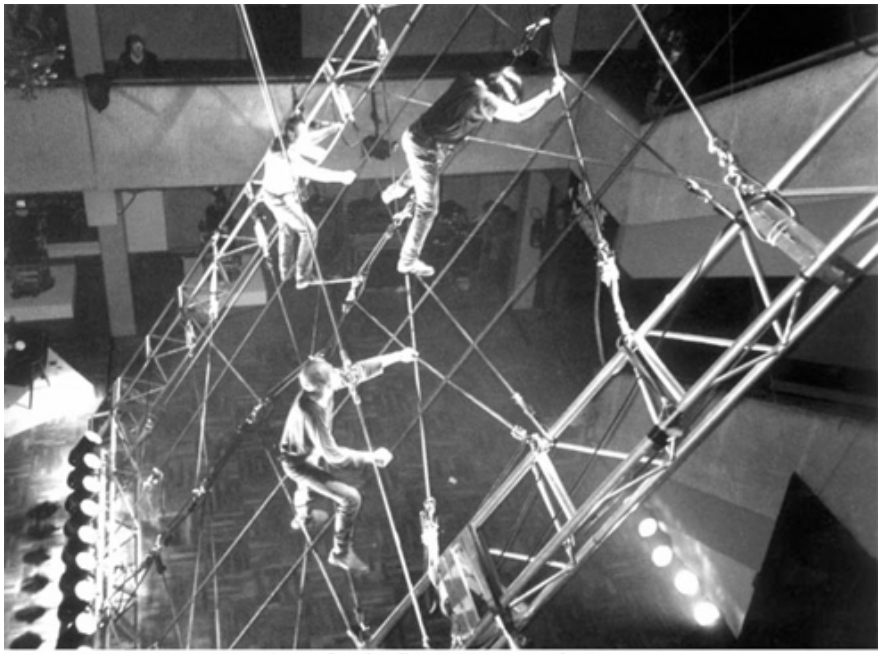


Figure 3.9: Sensorband performing on the *Soundnet* 1998

range as compared to the human body. Post-digital musicians now seek to create new modes of expression beyond these limitations and are creating all manner of interfaces which acknowledge and are adapted to the biological reality of the body. [25]

Returning to Michel Waisviz, an early example of this approach can be found in one of his instruments, *The Hands*, considered one of the first digital gestural music controllers. Designed at STEIM in the late 1980s from the bottom up for realtime bodily control, *The Hands* consist of 2 wooden shapes for the performer's hands which are packed with finger buttons, ultrasonic sensors, and tilt sensors (Figure 3.10). Connected to STEIM's LiSa realtime performance sampler, Waisviz was able sculpt sound itself in mid air, reminiscent of a theremin for musique concrete. By approaching the design through gesture as opposed to utility, STEIM created an example of an immensely performative digital instrument which both frees sound and embodies its performance through gesture. [26]

Experimental musician Joel Ryan of STEIM further states that this gestural nature is required for a successful live instrument. Physical effort is one of the requirements of traditional instruments that was removed by electronic and digital sound manipulation and synthesis, yet this same effort is what brings life

Figure 3.10: Michel Waisviz with *The Hands*, the first digital gestural music controllers, late 1980s

to the underlying musical processes. Drawing a bow along a string not only demonstrates how the sound is created but adds expanded possibilities in both visual and sonic expression. In fact the physicality of the performance interface helps give definition to the modeling process itself. The physical relation to a model stimulates the imagination and enables the elaboration of the model using spatial and physical metaphors. The image with which the artist works to realize his or her idea is no longer a phantom, it can be touched, navigated and negotiated with. [27]

From this physicality, comes what I term “liveness”: the danger of failure in a live performance and the feeling of witnessing a musician avoid it, i.e. walking the “razor’s edge.” There is a natural feedback between performer and audience and I feel that this sense of danger, that worry of “screwing up” is very important as a performer. Danger and excitement breed energy and sweat. I must play. I must express myself through music … I feel I come through much more intuitively in this medium than through visual

art alone. While the **Engineer** *can*, the **Artist** and **Musician** *must* as composer Arnold Schoenberg says:

> *I believe art is born of I "must", not of "I can". A craftsman "can": whatever he was born with, he has developed, and so long as he wants to do something, he is able to. What he wants to do, he* ***can*** *do … But the artist* ***must****. [28]*

I feel that whenever I channel that feeling of ***must***, I am able to make my most authentic work, the work that "must be made".

Experiments 2010-2012

My initial period of work at Carnegie Mellon consisted mainly of experimentation into interactive visual systems, content, and performance. It was a break from the focus over the previous several years on purely musical and engineering problems associated with the ongoing *robotcowboy* project. Instead of following instinct within the medium itself, I approached these works with a growing conceptual process.

Kinect Titty Tracker

> *… there's been a spate of videos using the technology, such as this man putting a BRA on himself*
>
> *- Australian news, The Age, Dec 2010*

In November of 2010, the Microsoft Kinect depth sensing camera went on sale, the first consumer-grade 3D camera at a cheap price. Knowing it would soon become the next "big thing", I made a project that would preemptively ridicule the explosion of subsequent over-enthusiastic demos using the device: the *Kinect Titty Tracker*. The software follows my manboobs, draws pasties on top, and music is played when boobs are detected (Figure 4.1). The entire concept resulted from a single question: what would be the stupidest thing I can do with this soon-to-be ubiquitous technology? A depth camera is great for finding a body in space and then calculating the two closest points in an assumed chest area (Figure 4.2). Further, the virtual bras and pasties can be projection mapped onto the actual chest being tracked. (Figure 4.3)

Ironically, the system does not work well with larger breasts as I chose a simple tracking algorithm and only had myself for testing. The assumptions about its effectiveness made when viewing the documentation video online are entirely wrong: it only works if I'm standing in the right place and it only works on manboobs … mine. However, in the early explosion of Kinect "hacks", this proved to be more than enough evidence for my "mastery of the medium":

> *This is ***** from Germany and I work in the advertising industry. I'm wondering whether its*

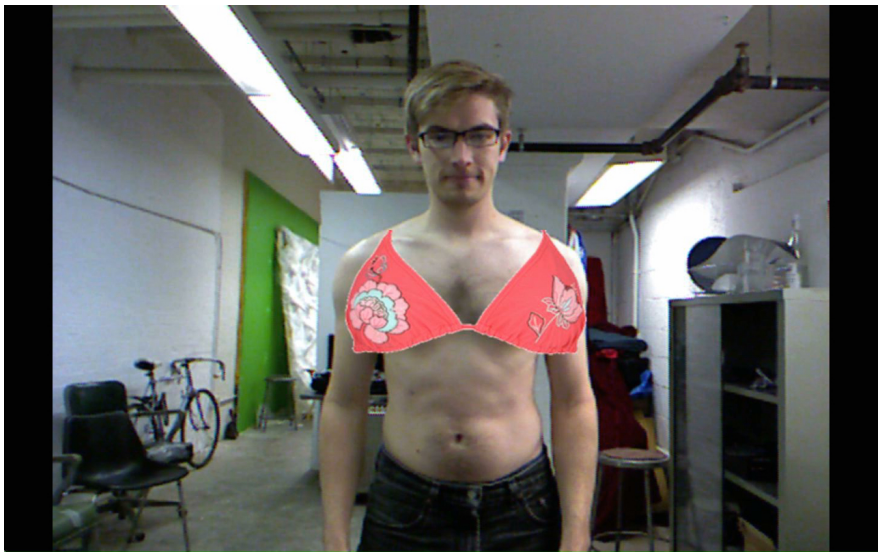


Figure 4.1: *Kinect Titty Tracker* video still 2010

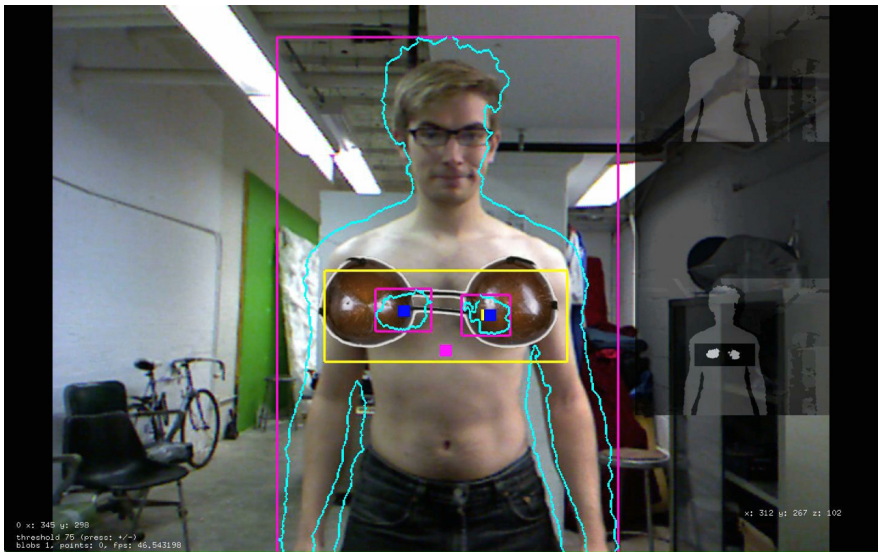


Figure 4.2: *Kinect Titty Tracker* video still showing tracker debug view 2010

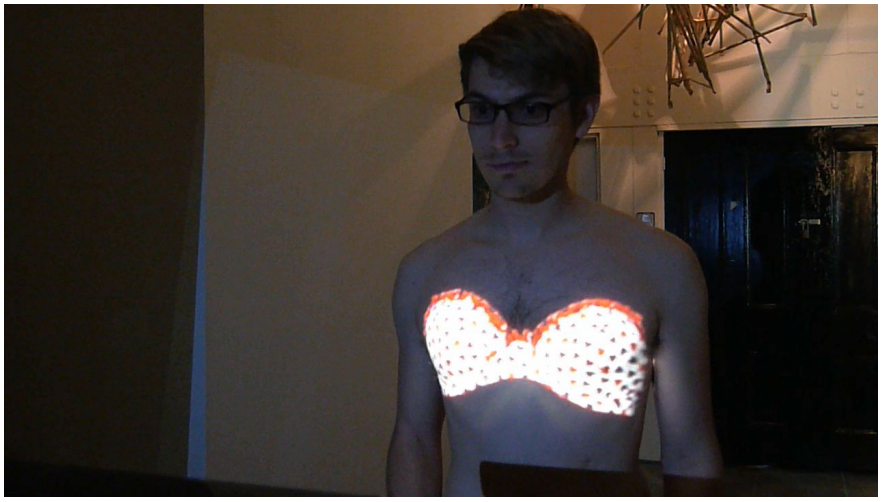


Figure 4.3: *Kinect Titty Tracker* video still showing projection mapping of a virtual bra 2010

possible for you to hack a Kinect to do hand detection (gestures like grabbing and swiping) and foot detection (just detect shape and orientation so we can map 3D shoes onto them).[1] *- job inquiry over email, Jan 2011*

[1]This is a actually a non-trivial task, especially considering the “flickery” edges in the Kinect depth image.

The system itself was built over the course of 2 weeks and the resulting video can be considered an artifact of a single performance, that is a single take. It was important to me that I perform "live" as opposed to demonstrate or intercut multiple takes in order to increase both its authenticity and situational humor. The choice of performance movements and music, "Hot Stuff" by Donna Summer, play off of the tongue-in-cheek sexual nature of the tracking system. I performed the admittedly easy role of "self serious engineer telling an inside joke". This was *sometimes* picked up on by online commenters, as seen on reddit:

> ***ubernicholi***
>
> *I feel like I just got trolled into watching a shirtless guy dance to "hot stuff" for two an a half minutes.*
>
> ***KingoftheBrits***
>
> *I don't disagree, yet for some reason I find him incredibly endearing.*
>
> ***feyyd***
>
> *It was his gentle sway.*[2]

[2]This "gentle sway" was actually necessary as I needed to move back and forth *just* enough to make sure I was in the correct position for the tracking system to work. *Shhh, don't tell anyone.*

Also on Kotaku, a popular gaming culture news site:

> ***BigDikJohnson***
>
> *Using a Kinect to get laid:*
>
> 1) *Get a girl back to your place. Don't do anything illegal.*
> 2) *Describe your Kinect project; she'll want to hear about it, really she will.*
> 3) *Tell her you want to see if it can track female boobs. She'll be happy to help, in the name of science.*
> 4) *Score! It's really that easy*.*
>
> **Results not typical.*

The *Kinect Titty Tracker* video was featured on a number of blogs during the initial interest into "Kinect hacks" in late 2010 and continues to pop up, now and then, in articles related to the original Kinect camera. It also managed to reach both online and broadcast television in Austria, France, & Australia to my knowledge.

Balloon Project

> *A machine stands in a room surrounded by balloons. Circulating fans blow the balloons over the machine which creates sound based on their movements. - Balloon Project proposal*

Have you ever seen a neutrally buoyant balloon? If the air temperature & pressure are right and the balloon has the correct helium to air mixture, it will float completely still and a slight puff of wind will send it lazily away.

Developed for the 2011 1st & 2nd year MFA Graduate show entitled "Fresh Baked Goods" at Bakery Square in Pittsburgh, the *Balloon Project* is a computer vision and audio synthesis system which sonifies the movement of balloons. 100 balloons were released into a 20x20 foot space enclosed by walls on two

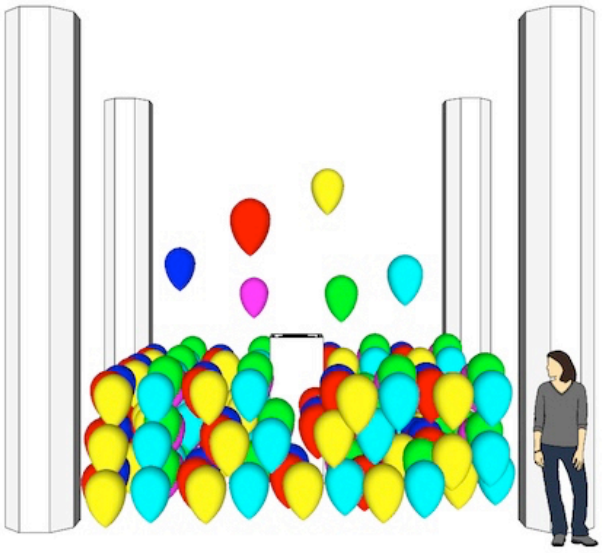


Figure 4.4: *Balloon Project* installation design sketch 2011

Figure 4.5: *Balloon Project* installation at Bakery Square, Pittsburgh PA 2011

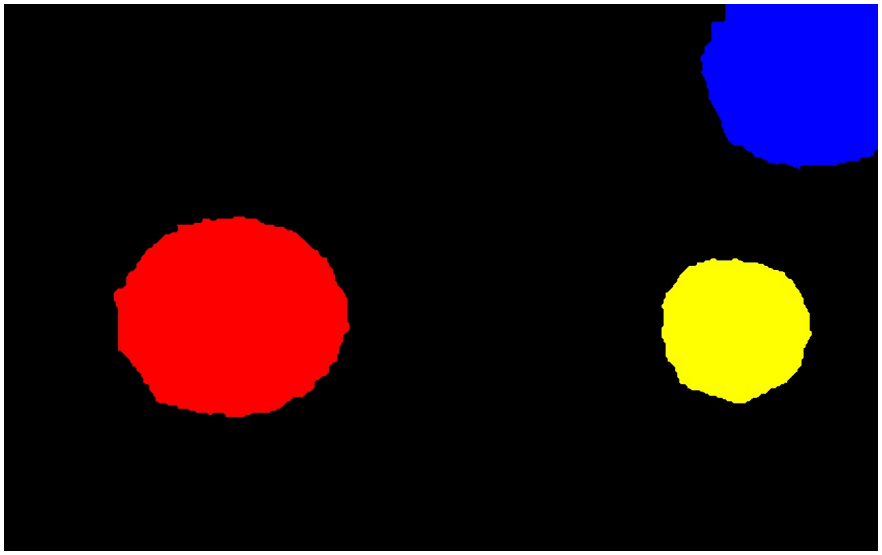


Figure 4.6: *Balloon Project* computer vision balloon tracker visualization 2011

sides and fishing line on the two open sides (Figures 4.4 & 4.5). The balloons were filled with a partial helium mixture to achieve near neutral buoyancy and a set of fans circulated them through the space and over a central wooden box containing a computer and depth sensing camera facing upwards. The computer vision system was written to search for "round things" (Figure 4.6) and produce a synthesized instrumental sound using the distance from the floor for pitch (y axis) and left & right position to set stereo panning (x axis). A visualization of this balloon tracker was shown on a monitor embedded in the backside of the wooden box. (Figure 4.7)

The *Balloon Project* system has two modes:

Mode 1: Tones

Balloon height and x/y position control the pitch and panning of a treble and bass voice. The tones can be quantized into a certain key or a glissando can be employed for a theremin-style effect.

Mode 2: 99 Luftballons

The playback speed of Nena's *99 Luftballons* is controlled by balloon height. The balloons must be kept in the air for the song to play. Feed the machine.

Mode 1 is designed for general installation use while Mode 2 is used for a special performance which

Figure 4.7: *Balloon Project* central wooden box containing computer, light, and Kinect camera facing upwards 2011

requires the operator to constantly throw balloons into the air over the camera's field of view. The height of the highest balloon controls the playback speed of Nena's 1980s German New Wave anthem *99 Luftballons* which slows as the controlling subject falls, sounding much like the slowing of a turntable. Users must then "feed the machine" with their energy in order to keep the song going.[3]

Numerous unforeseen problems were encountered. The climate in the raw exhibition space was very dry as well as dusty from an unfinished concrete floor which caused a number of balloons to spontaneously explode due to static electricity. Since I spent almost 2 weeks working in the space ahead of time, the dust had the side effect of bringing on a sinus infection and I spent the remainder of my time wearing a particulate mask. The floor space used by the installation was about twice as large as needed and I consequently tried to fill it with more and more balloons. Inflating balloons using a hand mix of helium and compressed air was a time-consuming practice and I should have organized volunteers to handle this instead of spending 4+ hours before the opening developing fat, red fingers from tying latex. Lastly, it never occurred to me that a space full of floating balloons during an opening night party with alcohol and a DJ might become an adult-sized ball pit (Figure 4.8). It was, many balloons were popped, with my resulting documentation suffering for it.

[3]Mode 2 was also a performative release from the frustration leading up to the opening night and commentary on my predicament.

Figure 4.8: *Balloon Project* installation turns into adult-sized balloon popping pit 2011

Criticism I received indicated a desire for more "depth" in the piece. Although I had achieved my primary goal of engaging visitors via the movement of the balloons and their resulting sound within the environment of the installation, I did not have any conceptual interests beyond these formal elements. Initially, I took this to mean "the piece doesn't communicate anything" and was somehow lacking. Looking back, I now interpret this desire for depth to also signify a desire for more variation. Originally, I had grander designs for the system, including color tracking, projection mapping onto the bottom of the balloons, and a larger variation of audio synthesis but I simply underestimated the amount of time needed to construct the installation and write the software. This was a classic case of building an engineering solution without considering the potential conceptual and poetic aspects of the expression, so the project suffered. Even the title for the piece, "Balloon Project", reflects its unfinished nature.

Venice Mouth

> *words become the shape of my mouth as I read Geometry and Non - Venice Mouth documentation video*

I was given an assignment to create a screen print based on the city of Venice inspired by the poem *Geometry and Non* by Jennifer Scappettone (see Appendix).[4] As a performer, I decided to create a piece of

[4]Actually, it turned out that this was an erroneous amalgamation of various Scappettone poems which was given to us as the real thing by mistake.

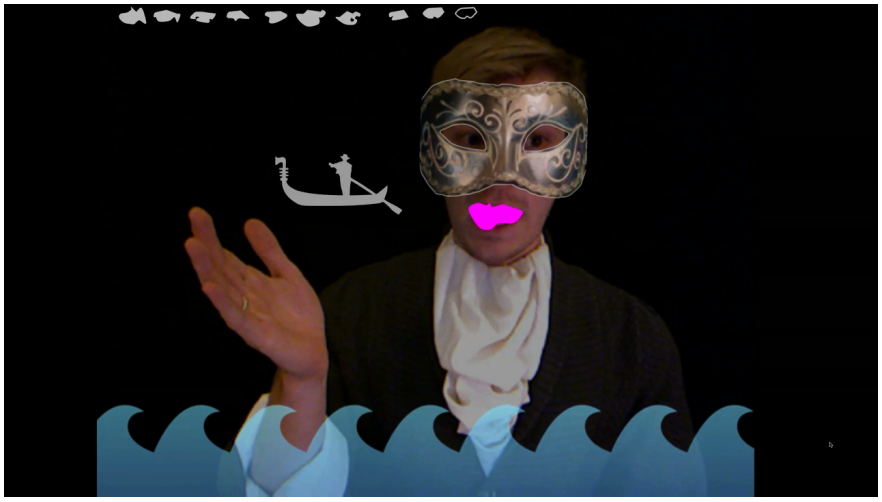


Figure 4.9: *Venice Mouth* video still, the gondola appears when the word “Venice” is spoken 2011

Figure 4.10: *Venice Mouth* video still showing bubbles emitted by the mouth as the lagoon rises 2011

software that could turn a reading of the poem into its visual analog. This singular performance generated both a high quality print and video documentation of its creation.

The scene opens with a puffy shirted Venetian (the author) wearing a virtual masquerade mask while the fervent *La Serenissima (Theme From ‘Venice In Peril’)* by Rondo Veneziano plays in the background (Figure 4.9). The shape of his mouth is recorded for each word as he recites *Geometry and Non* to a sense of urgency before the ever rising waters of the Venetian lagoon consume him. Once submerged, bubbles escape from his lips (Figure {4.10). The scene takes approximately 1 minute.

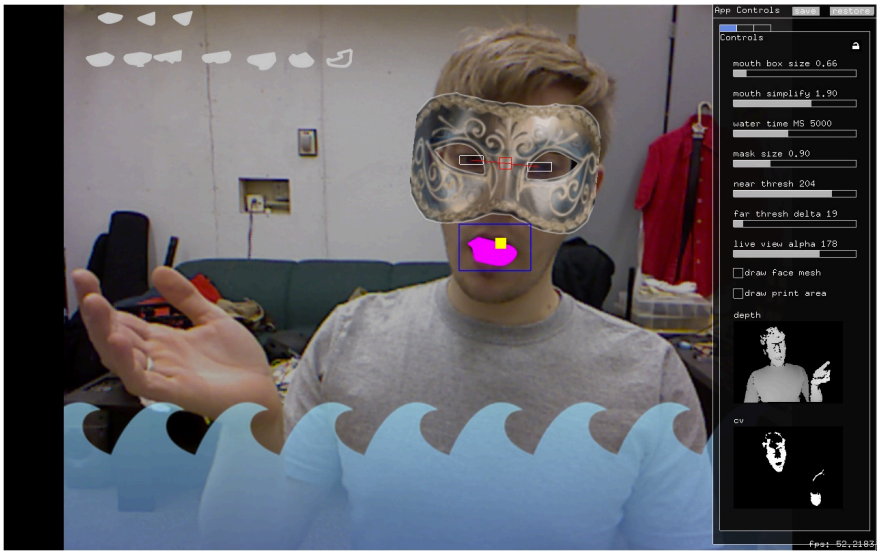


Figure 4.11: *Venice Mouth* computer vision tracker debug mode 2011

This project grew from my initial reaction to being asked to "interpret" a piece of text to produce a print design: I wished I could simply recite the poem and be done with it. This turned into 2-3 weeks worth of work that evolved into an elaborate piece of custom software which included face tracking (Figure 4.11) and animated scene compositing. Once I focused on the basic idea, visual elements of Venice itself were developed including the face & mouth tracking, virtual mask, and rising waters of Venice which helped establish a speed and timespan. Starting from a simple conceptual idea, the project expanded through experimentation and intuition yielding a more satisfying process and artifacts than in the previous *Balloon Project*.

As with the *Kinect Titty Tracker*, the system was built in order to facilitate the recording of a singular performance (Figure 4.12). It was important that I complete the scene in one go and that there were no edits using multiple takes. The music and rising visual metaphor added a time limit and "liveness" to my performance, even after an hour of practice. Mouth shapes for each word were recorded via manual trigger and abstracted through software smoothing of the sometimes imperfect contour within the Kinect depth image. The ultimate result of this performance-as-video was the actual physical screen print which was created from a high quality PDF exported from the software (Figure 4.13).

Figure 4.12: *Venice Mouth* performance setup 2011

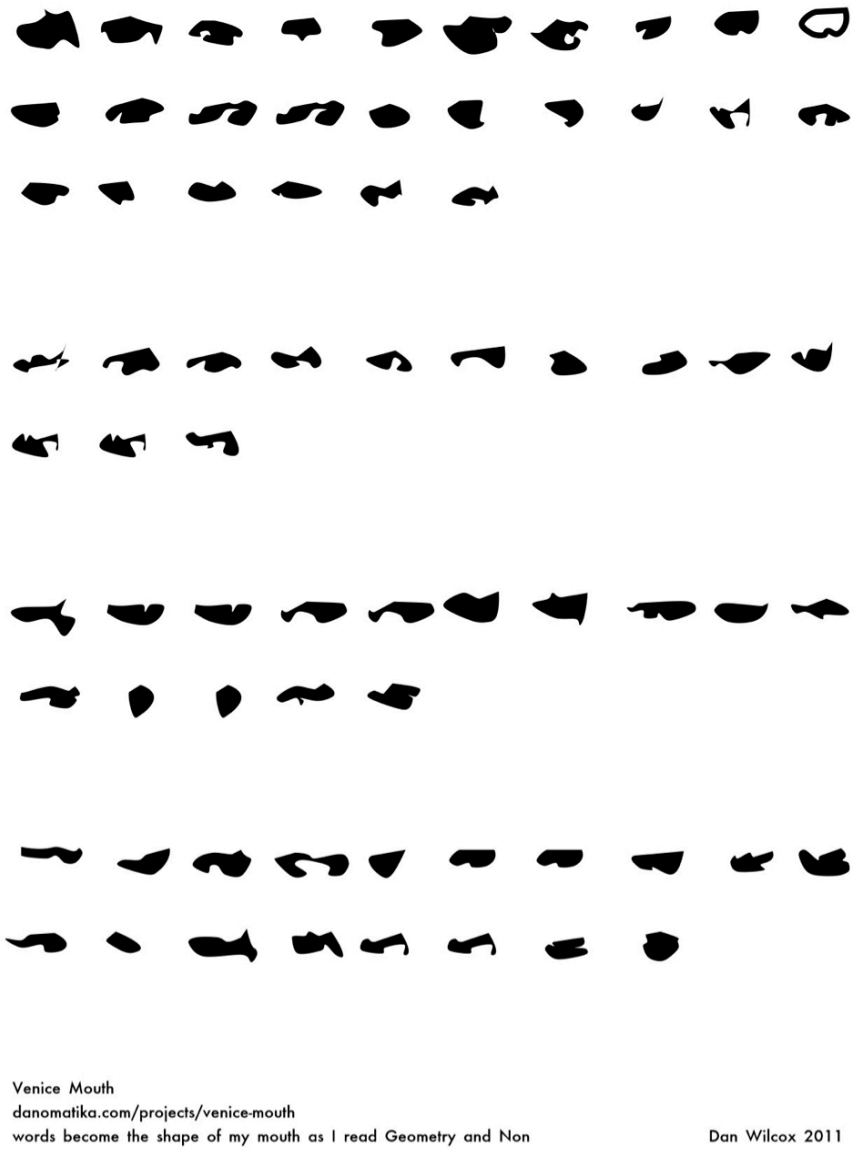


Figure 4.13: *Venice Mouth* print, the outlined glyph represents the word “Venice” 2011

Robot Rumble

> *What if today's robotic technology could be put to the test in a one-on-one wrestling tournament? How would a Honda ASIMO stack up against the Boston Dynamics Big Dog? Could a Google Self-driving Car defeat the high-flying power of a Reaper drone? Uh oh, RIBA the nurse robot was talking smack about the CMU Crusher! It's on! - Robot Rumble promo*

Developed for the 2012 1st & 2nd year MFA Graduate show entitled "Extra Fancy" at Bakery Square in Pittsburgh, *Robot Rumble* is a live multimedia performance where actors portray real-life robots in one-on-one bouts in the style of backyard wrestling and the 1980s WWF (World Wrestling Federation). Major themes of robotics and society are explored through cardboard-crushing, masculine soap operatic action. The robots are constructed as costumes using simple cardboard materials and paint.

The main goal of *Robot Rumble* is to introduce real, contemporary robots to a general audience who may not be aware of their very existence. For many, robots are still the stuff of science fiction yet research and development of advanced robotics is exploding, often due to ties to military funding through organizations such as DARPA (Defense Advanced Research Projects Agency) and CMU's own Robotics Institute. The nature of robotics is different depending on the application and country of origin. The Japanese are developing robots as assistants and nurses for their aging population while the United States is focusing on drones, autonomous military vehicles, squad level pack mules, and exoskeletons. Correspondingly, the robots of *Robot Rumble* are grouped into two factions: the HELPERS and the MilBots.

HELPERS

Honda Asimo

Description: advanced humanoid companion and servant

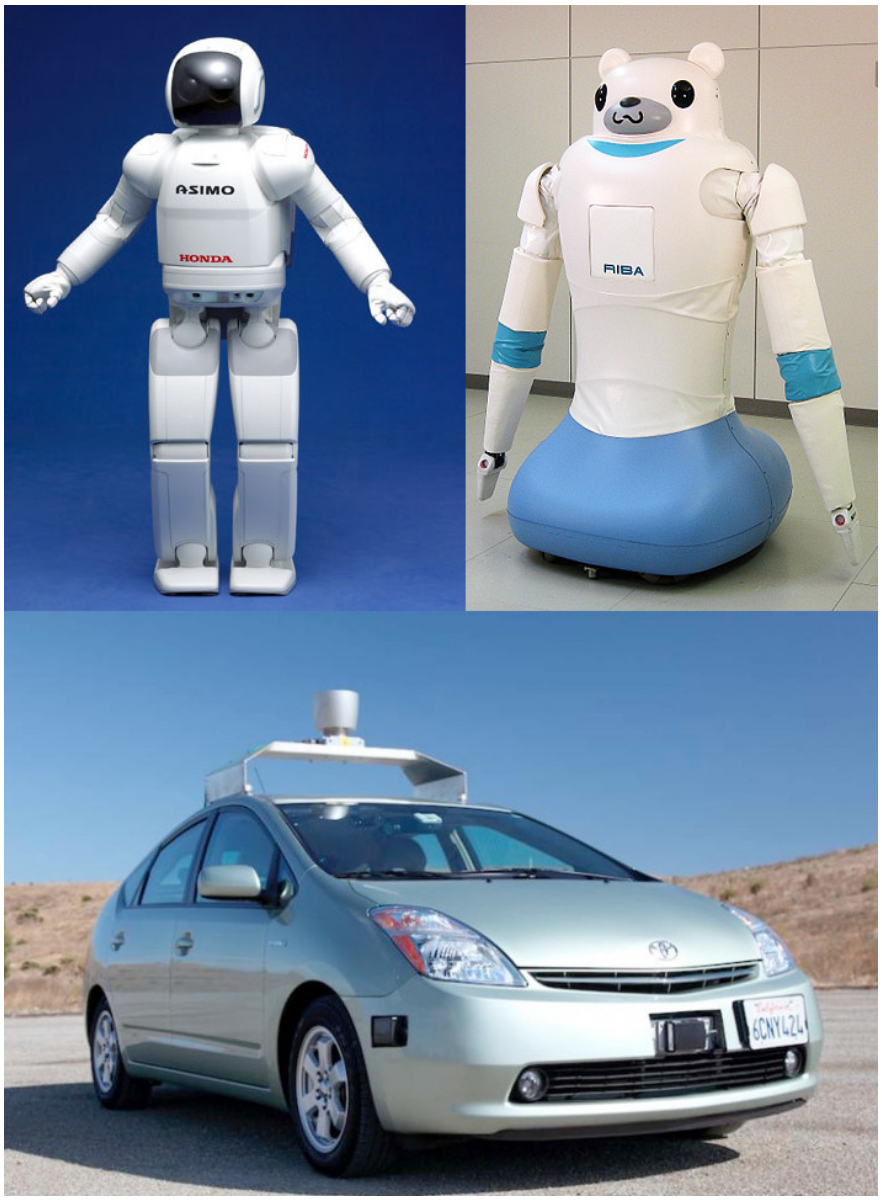
Country of Origin: Japan

Theme Song: Hikashu - *White Highway* (Japanese avant-pop)

RIBA (Robot for Interactive Body Assistance)

Figure 4.14: Video still of *Robot Rumble* at Bakery Square 2012, robotic servant ASIMO (right) vs military pack mule BigDog (left)

Figure 4.15: Video still of *Robot Rumble* at Bakery Square 2012, nurse robot RIBA (left) celebrating her defeat of autonomous tank Crusher (right)

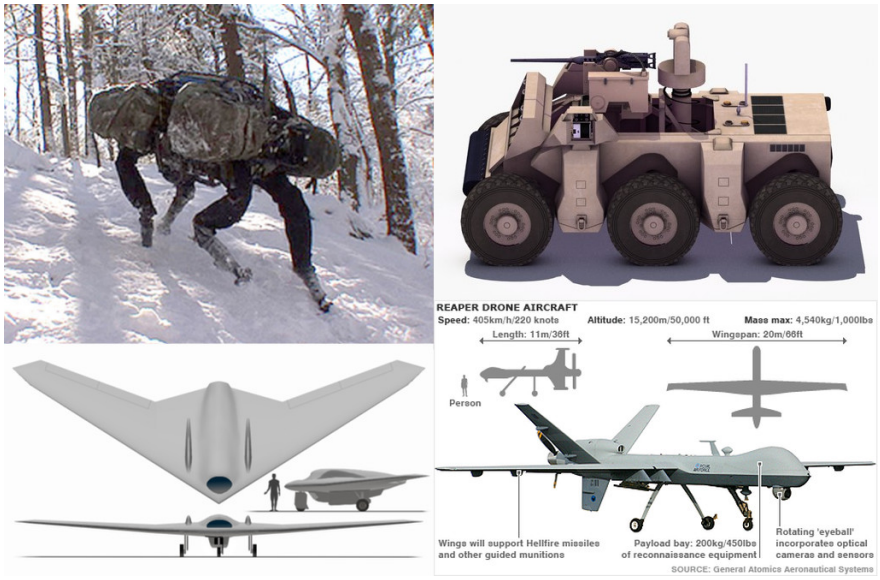


HELPER robots, clockwise from upper left: Asimo, RIBA, Google Self-driving Car

Description: nursing-care assistant, first robot able to lift a person from a bed or into a wheel chair

Country of Origin: Japan

Theme Song: RIBA promotional video background music (cutesy synth instrumental)



MilBot robots, clockwise from upper left: BigDog, Crusher, Reaper, Sentinel

Google Self-driving Car

Description: ongoing platform for Google's self driving car development, based on the Toyota Prius

Country of Origin: United States

Theme Song: Judas Priest - *Turbo Lover*

MilBots

Boston Dynamics BigDog

Description: smart quadrupedal robotic pack mule for the US military

Country of Origin: United States

Theme Song: MC Chris - *Robot Dog*

CMU Crusher

Description: highly autonomous tank for battlefield reconnaissance and "crushing" ability, developed at the Carnegie Mellon Robotics Institute

Country of Origin: United States

Theme Song: Godsmack - *Awake*

Insentec Galaxy-Starline milking robot

RQ-170 Sentinel

Description: remotely-controlled stealth reconnoissance drone, used by the US Air Force

Country of Origin: United States

Theme Song: Violent Femmes - *Gone Daddy Gone*

MQ-9 Reaper

Description: remotely-controlled drone armed with Hellfire missiles and guided bombs, used by the US Air Force

Country of Origin: United States

Theme Song: Iggy Pop - *Search & Destroy*

Unaffiliated

Insentec Galaxy-Starline

Description: robotic milking machine, automatically cleans and milks using computer vision controlled onboard teat cups

Country of Origin: The Netherlands

Theme Song: Devana DeMille - *You've Gotta Have Boobs*

By placing these real world robots into a humorous environment through simple, yet effective cardboard costumes (Figure 4.16), we can compare and contrast their purpose and design through exaggerated wrestling personas complete with introductory music and videos edited from existing promotional materials put out by their makers. The theme song and editing style of these intros are chosen in a tongue-in-cheek manner. The Google Self-Driving Car, for example, enters to *Turbo Lover* by Judas Priest over two contrasting videos which are interleaved to balance the companies optimism with the public's skepticism of a crazed robot run amok: blind Google Self-Driving Car user #00001 Steve Mahan running errands vs. test drive footage on a closed parking garage roof that shows the car careening with tires squealing up to 40 miles per hour on a short looped course. Similarly, the CMU Crusher's theme, *Awake* by nü-metal band Godsmack is used in US Navy recruiting commercials. Crushers entrance video is pieced together from promotional materials released by its CMU research group, DARPA, and the Military Channel, complete with faux video game stats card and car crushing demonstration to a female voiceover:

> *What you see are laser range finders. Crusher uses these in combination with radar and optical cameras to get its bearings … and to decide what to avoid and what to CRUSH. - CRUSHER: Autonomous Ground Vehicle, IEEE Spectrum Online video*

Since the *Robot Rumble* performance took place on a single night, the costumes and videos themselves were displayed as artifacts within the wrestling "ring" for the course of the exhibition (Figures 4.18 & 4.17). The Google Self-Driving car was built using cardboard over a wooden frame on wheels with capacity for two "passengers" (Figure 4.19). During a special performance on the opening night, the car made its way around the large exhibition floor space randomly losing connection to Google Maps and disabling its collision avoidance algorithms, resulting in numerous art patron fender benders.

Overall, the performance went well and the volunteer robotic actors where more than up to the task. I did have a few issues with cuing audio and video as I was trying to handle both A/V & announcing at the

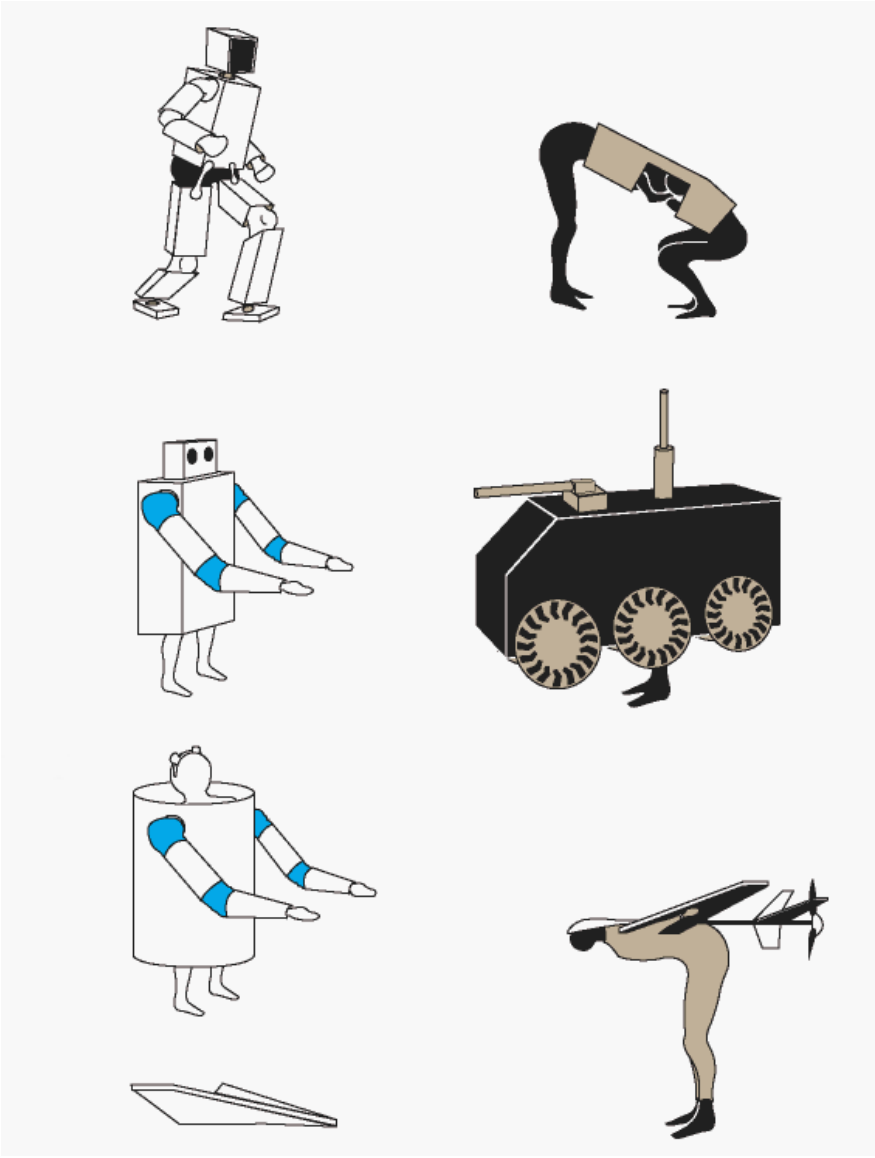


Figure 4.16: *Robot Rumble* costume design 2012, clockwise from upper left: ASIMO, BigDog, Crusher, Reaper, Sentinel, 2 alternate RIBAs

Figure 4.17: *Robot Rumble* installation view at Bakery Square with costumes and promotional video 2012

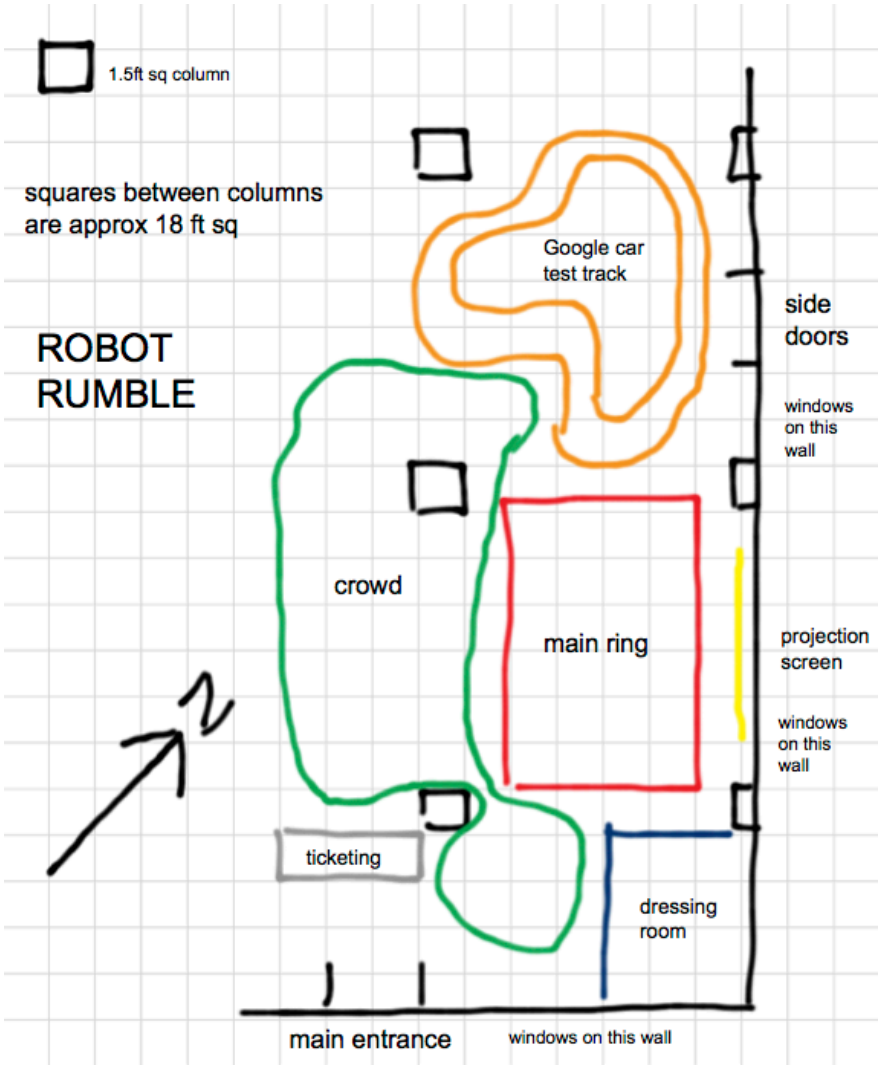


Figure 4.18: *Robot Rumble* floor plan at Bakery Square 2012

Figure 4.19: *Robot Rumble* Google Car 2012, (left) in development (left) and (right) driving on its test course with passengers

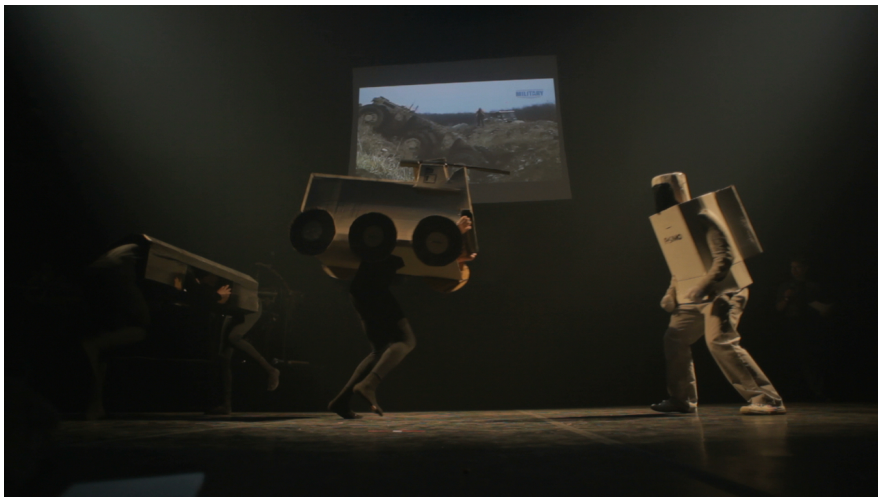


Figure 4.20: *Robot Rumble Rematch* video still 2012, ASIMO vs BigDog with the surprise appearance of Crusher

same time. This was corrected in the follow up *Robot Rumble Rematch* which occurred 2 weeks later as part of the *Cyborg Cabaret* using a pretracked intro video with baked-in background music so I could focus on announcing. (Figure 4.20)

As for the outcomes, first, the Crusher was dropped by RIBA after its optical scanners were knocked out (Figure 4.15). Second, ASIMO triumphed thanks to quick thinking and help from the Galaxie-Starline robotic milking machine which drained the Boston Dynamics BigDog of its hydraulic fluid (Figure 4.21). Last, after the Google Self-driving Car's pedestrian avoidance system was damaged by the near miss of the Reaper drone's Hellfire missile (Figure 4.22), the car utilized Google search and Google Maps to locate the Reaper's remote flier and run him down, leading to the crash of the now pilotless drone. The car itself

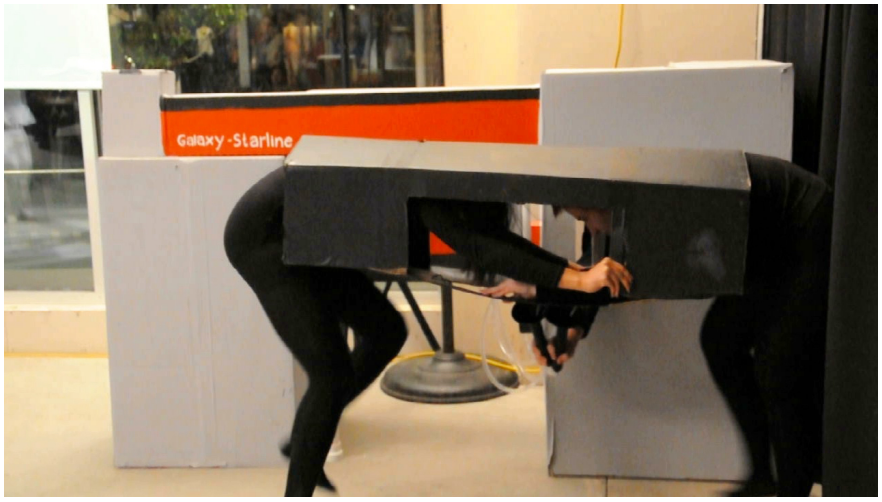


Figure 4.21: *Robot Rumble* video still 2012, BigDog being drained of hydraulic fluid by the Galaxy-Starline milking robot

completely surprised the audience since its operator wore black and hid inside its black painted interior before the show began. When its intro was played, the car suddenly "came to life" from behind the audience and took off into the exhibition space.

In the end, the "good guy" HELPERS defeated the "bad guy" MilBots. Wrestling is soap opera entertainment and everyone likes rooting for the heel, so the script follows along as each MilBot is ultimately defeated by a hero HELPER in a last minute turn around. Feedback was positive and many audience members were introduced to a small slice of current robotics development which will soon be shaping our world, whether we like it or not.

(See the scripts for both *Robot Rumble* & *Robot Rumble Rematch* in the Appendix.)

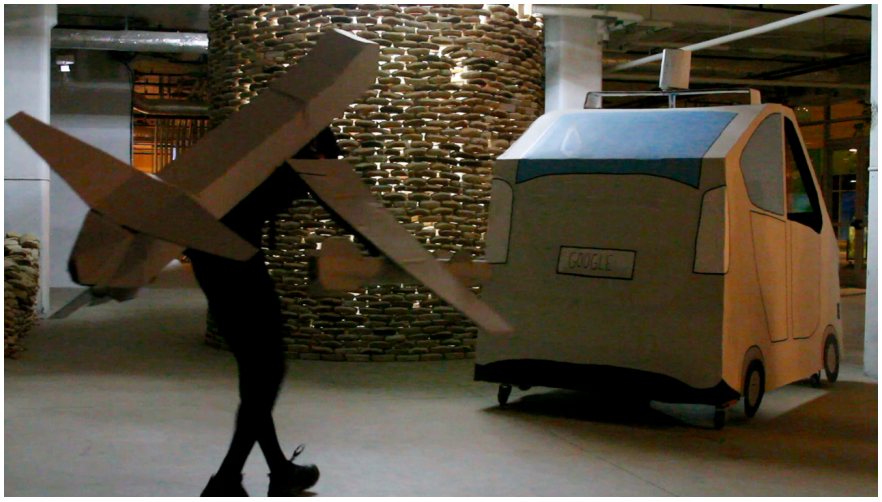


Figure 4.22: *Robot Rumble* video still 2012, Google Self-driving Car being pursed by the remote-controlled Reaper drone

Cyborg Cabaret

> *The Cyborg Cabaret explores human, robot, and cyborg relationships in a variety show format featuring everything from cutting edge metal machines to cardboard-suited meat bags. Expect tear-jerking vignettes, frequent non-sequiturs, and lots of humor through avant art-meets-science theater. - Cyborg Cabaret promo*

The *Cyborg Cabaret* was a one night variety show collaboration between the author and roboticist Heather Knight (Figure 4.24). Supported by the 2011 CMU School of Art Interdisciplinary Award, we organized an open call for collaborators and assembled a 90 minute, two act variety show of 8 sketches in total. Planning began 9 months beforehand with meetings and rehearsals coordinated in the 4 months leading up to the show. The *Cyborg Cabaret* took place at the New Hazlett Theater in Pittsburgh, PA on April 27th, 2012.

The goal of the *Cabaret* was to explore new insight into human-machine relationships with a varied background cast in a theater setting. The 8 acts explored numerous themes in a variety of ways: movement via synchronized audio & stage light movement, an esoteric journey of human technology from simple tools to robotics (Figure 4.25), a human-cyborg-human love triangle, cyborg existential crisis through operatic voice (Figure 4.26), alienation in public punctuated by an exploding prosthetic arm (Figure 4.27),

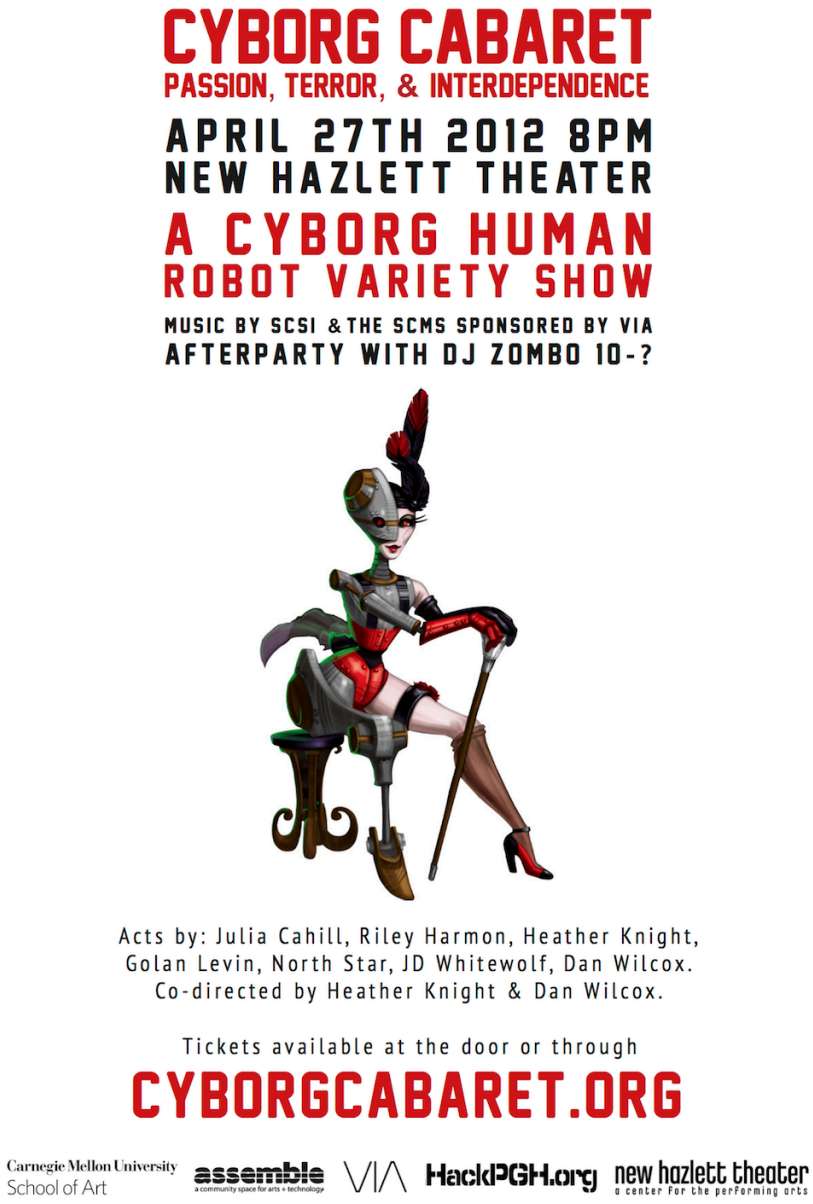


Figure 4.23: *Cyborg Cabaret* flier

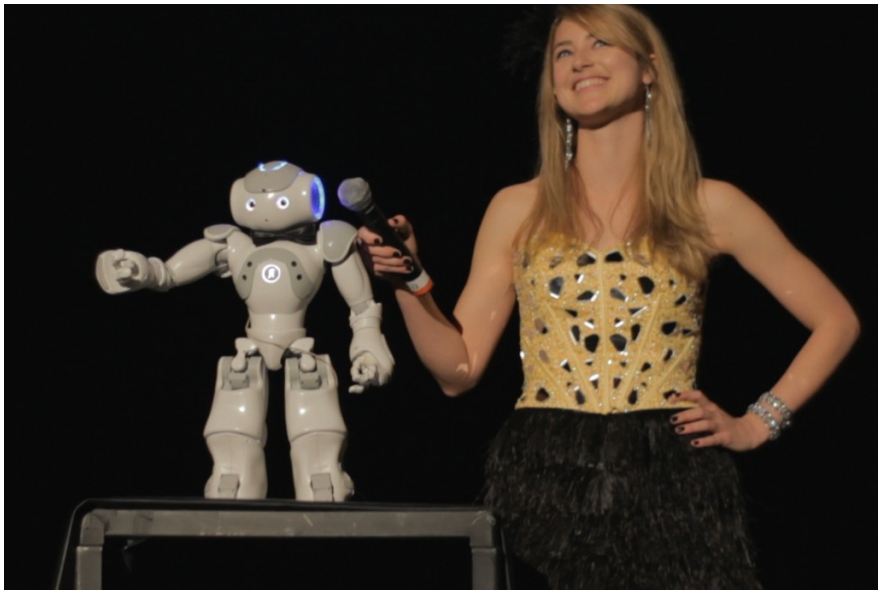


Figure 4.24: Heather Knight assists her robot Data with his stand up comedy act during the *Cyborg Cabaret* 2012

a contemporary robot wrestling match (Figure 4.20), and a cyborg burlesque routine including the pouring of machine oil and ripping of skin (Figure 4.28).

(See the Appendix for a complete list of acts from the *Cyborg Cabaret* program)

Heather and I acted as co-producers and we collaborated with a stage director, lighting designer, musicians, and the individual sketch writers, actors, and performers. Our open call succeeded in bringing together a diverse group representing both CMU artists and scientists, as well as greater Pittsburgh community members. We worked with our grant budget and the staff at the New Hazlett to produce a multimedia presentation in a black box theater format including sound, lighting, and video projection. We established a Tumblr blog and Twitter account to generate ideas early on which were followed up by a full website (cyborgcabaret.org) 3 months before the show. Fliers and posters were used for print promotion (Figure 4.23), the show was featured on the front page of the Carnegie Mellon University website, and we were interviewed by the Pittsburgh Post-Gazette. Thanks to online and print interest, the night of the show was sold out and played to an audience of over 300.

Reviews were mixed. We were complimented for putting on a “fun show” and doing a great deal with our relatively small budget. One complaint was the lack of “real robots” which stemmed from a dis-

Figure 4.25: The Angel and the Robot in North Star's *Transmutation of Man*, part of the *Cyborg Cabaret* 2012

Figure 4.26: JD Whitewolf performing *The Cyborg's Lament* in the *Cyborg Cabaret* 2012

Figure 4.27: Riley Harmon's prosthetic arm blowing a fuse in *Disintegration (After Myself)*, part of the *Cyborg Cabaret* 2012

Figure 4.28: Julia Cahill pulling off a piece of living skill from her endoskeleton while performing *Cyborlesque* during the *Cyborg Cabaret* finale 2012

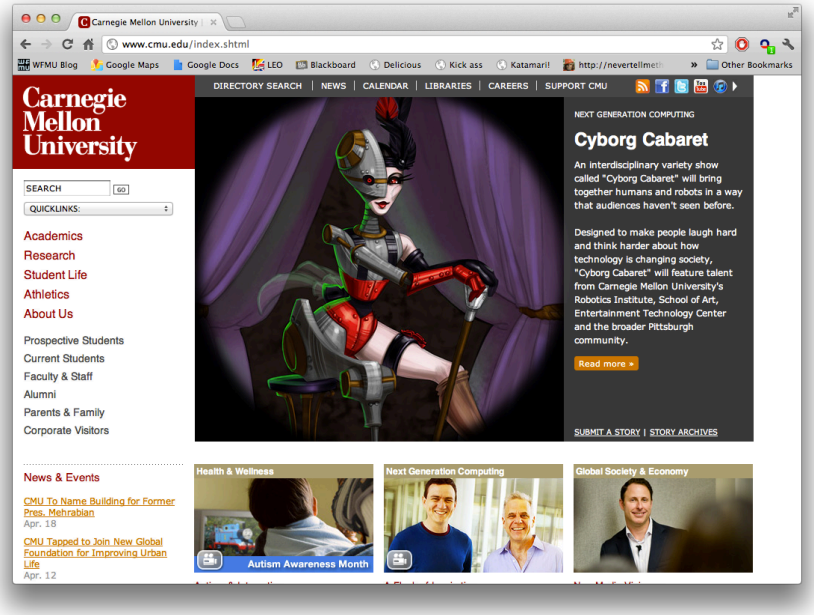


Figure 4.29: *Cyborg Cabaret* on the front page of cmu.edu 2012

appointingly late cancellation of an act using research-grade robots from the CMU Robotics Institute. A second issue was our inexperience as directors and producers for a large event such as the *Cabaret* which hampered our overall progress. Afterwards, I realized I had missed opportunities to provide useful and frank feedback to our performers when it would have been both helpful and necessary. Third, a collaboration is a unique relationship that sometimes involves negotiation and compromise. I feel Heather and I did not have as much experience working together and making our mutual concerns known and roles defined. Lastly, we did not originally recognize the expectation of the audience in a professional theater setting. They were in a theater and they expected "professional drama" while none of us had formal theater training. For many, I imagine the show came off as amateurish at times and, although this may not be an issue in an art or alternative/experimental performance setting, I feel our production level did not help us in front of a theatrical audience.

All in all, I'm proud of what we did accomplish which was to bring a diverse group of people together, create a feature length show for scratch, explore human-cyborg-robot interconnection, and manage both a budget, ourselves, and the theater setting itself to pull it off. Judging from the sold out crowd, the interest level was definitely there even if we did not reach the perhaps unreasonable goal we had managed to set

for ourselves. Ultimately, I was able to benefit from this experience and my relationship with the staff of the New Hazlett while developing *robotcowboy: Onward to Mars* in 2013-14.

Heading to Mars

> *As with a lot of things in life, the hardest and most critical decision is to surrender your dreams of comfort. - author Wil McCarthy on the MDRS [29, p. 48]*

Heading to Mars is an artist book and exhibition compiled from notes, photos, and journalist reports from the author's posting at the Mars Society Mars Desert Research Station, Crew 119, December 1-14 2013.

As crew journalist, my mission was to document what life will be like for the first humans on Mars from a "feet on the ground" perspective. This work was research for *robotcowboy: Onward to Mars*, a live musical performance and concept album around the theme of humanity crossing the sea of space and touching down on a familiar new world.

What does it feel like to stand on another planet?

First photo of Earth from Mars at 86 million miles, Mars Global Surveyor May 8, 2003 - NASA/JPL

Mars on Earth

As of 2013, over 500 people have flown in space, 24 of which have traveled beyond low Earth orbit, and of these only 12 have stepped foot on the moon. This means only 12 people (all men) can tell you what it's like to stand on another astronomical object.

Countless science fiction books & movies have covered this subject, but nothing can truly compare to real life experience. With this in mind, various space programs and organizations have developed analog simulations, or "analogs". Current NASA astronauts train for International Space Station space walks at NASA's Neutral Buoyancy Laboratory [30], the Apollo astronauts practiced docking and landing on the Moon using elaborate computerized simulators [31], and researchers at NASA Ames conduct "Mars missions" at Haughton crater on Devon Island in the Canadian arctic. [32]

The Mars Society, a nonprofit space advocacy group promoting human exploration of Mars, initiated the Mars Analog Research Station (MARS) program in the early 2000s to build a series of Mars-like centers for experiential research:

Figure 5.1: The Mars Desert Research Station HAB (Habitat), Greenhouse, and ATVs

> *In these Mars-like environments, we will launch a program of extensive long-duration geology and biology field exploration operations conducted in the same style and under many of the same constraints as they would on the Red Planet. By doing so, we will start the process of learning how to explore on Mars. [33]*

The Mars Desert Research Station (MDRS) in eastern Utah is the second deployed station in the MARS program [34], after the Flashline Mars Arctic Research Station (FMARS) on Devon Island in Canada. Operated for over 10 years, the MDRS selects applicants for both domestic and international crews consisting of scientists, engineers, astronauts-in-training, & artists for 2 week shifts in seasons stretching from fall to spring (Figure 5.1). Crews arrive with an overall mission plan and work with Mission Support day-to-day to coordinate resources, scientific data, EVAs (Extra Vehicular Activities), and crew medical information over a simulated communication delay. Similar to real world space missions, each crew member performs duties related to their background and expertise and are assigned one or two roles, including that of commander, executive officer, flight surgeon, engineer, journalist, & scientist - with the latter usually related to a specific field (e.g. astronomer, biologist, geologist, etc).

Crew members conduct EVAs wearing MDRS simulation suits complete with dome helmets and back-

packs with a simulated air supply (Figure 5.2). They must wait through air lock decompression and sterilization procedures when leaving their cylindrical 8 meter diameter Habitat (HAB) structure. The isolated MDRS Utah high desert location is within the geological Morrison Formation whose red & gray colored clay layers and lack of vegetation contribute to a very Mars-like locale. These elements combine for a high state of immersion for crew members, where the suspension of disbelief can occur and the experience of standing on another planet begins.

In the fall of 2012, I applied and was accepted for MDRS Crew 119. As an artist with an engineering background, it was time to do my "R&D for humanity" by getting a "feet on the ground" perspective at the Mars Desert Research Station. My ultimate goal was to use this experience in the development of the next version of my ongoing *robotcowboy* performance project: a one astronaut space rock opera.

Figure 5.2: A Mars Desert Research Station sim suit

Heading to Mars

I joined Crew 119 as a journalist for the first crew rotation in season 12 at the Mars Desert Research Station. *Heading to Mars* is my MDRS field journal compiled from reports, tweets, photos, & personal notes arranged by Sol (Martian day).

Crew 119

I was part of MDRS Crew 119 and we named our spacecraft the Phoenix One (Figure 5.3). We were the first crew for the 2012-2013 season and our rotation was Dec 1st - 14th, 2012. Each member of our 5 person crew had a specific role based on their expertise:

- Commander John Reynolds, pilot
- Executive Officer/Health Safety Officer Paula Crock, physicist / satellite data analyst
- Engineer Habib Palenfo, mechanical engineer / pilot in training
- Scientist Lisa Stewart, sociologist / psychologist
- Journalist Dan Wilcox, artist / engineer / musician

Although my official role was that of crew journalist, I also planned EVAs, wrote mission reports, and compiled maps and points of interest.

As we were the first crew in the season, there were no footprints or tracks left over from the last crew, so our rotation was a “first landing” simulation. We approached our 2 weeks as the first crew on Mars and began with a blank slate as pioneers, exploring and mapping the area.

Our mission goals were:

Crew 119: Laying the Groundwork

As the first crew on Mars, our mission is to

- *Explore & map the surrounding area*

Figure 5.3: Crew 119 mission patch by Habib Palenfo

- *Identify sites for detailed investigation by future crews*
- *Pioneer Martian soil usage*
- *Shakedown systems and procedures*
- *Integrate data collection*

As the vanguard for human exploration of the Red Planet, Crew 119 places an emphasis on exploration and applied science. Robotic satellite mapping from orbit has provided us with high level reconnaissance, but now it's our turn to scout on the ground, turning over rocks along the way. Our aim is to map the area and find sites for future detailed study, test existing systems, pioneer new ones.

Every step we take at Mars Base One paves the way for countless crews. [35, p. 15]

Journalist Role

As Crew Journalist, I wrote a daily report in this "first landing" perspective and compiled pictures to send to MDRS Mission Support for official press release to the MDRS Mission Reports page and the Mars Society

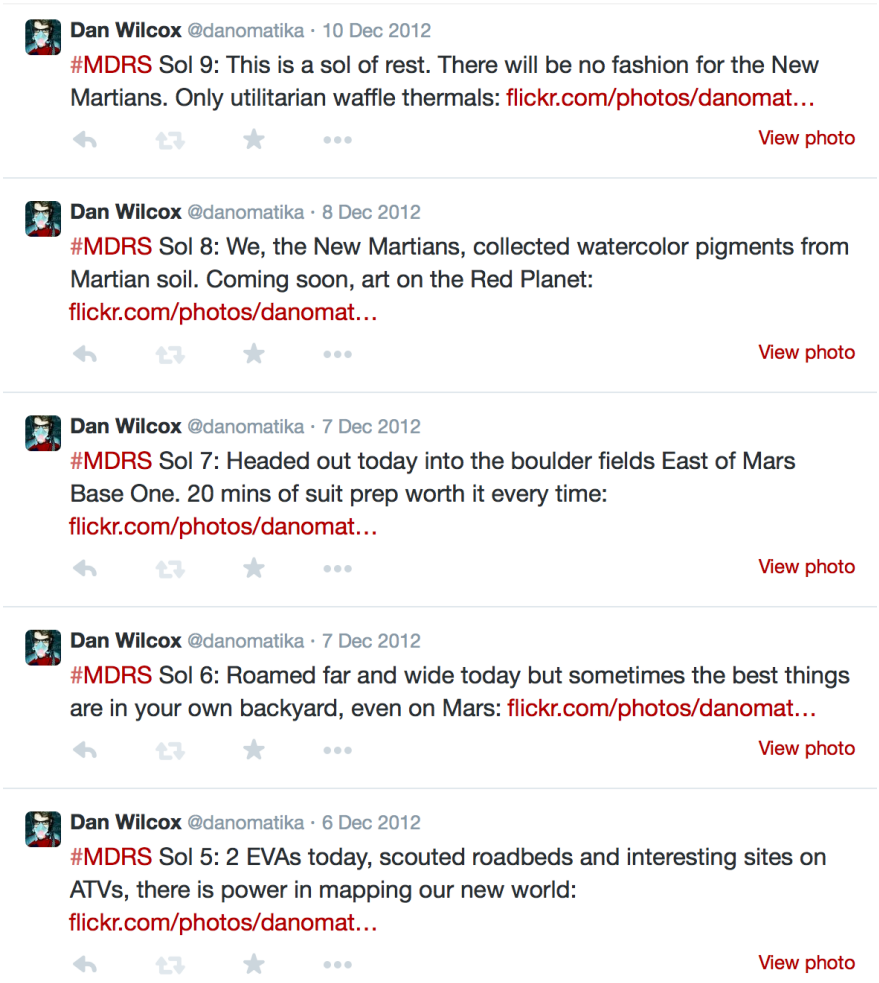


Figure 5.4: A selection of the author's tweets from the Mars Desert Research Station

Figure 5.5: One of the author's MDRS photos in BAUNETZ WOCHE #351

Facebook page. My images were published to the MDRS Flickr account and some are used on the MDRS & Mars Society webpages. Simultaneously, I personally tweeted the experience from my @danomatika Twitter account, condensing the day into 140 characters and a single photo. (Figure 5.4)

Additionally, several of my photos were featured in online articles about the MDRS, including Space.com [36] and German online architecture magazine BAUNETZ WOCHE's special on *Escapism*. [37] (Figure 5.5)

Crew engineer Habib Palenfo and I brought portable action cameras which we mounted to both the EVA suits and the MDRS teleoperated rover. In all, we recorded about 30 GBs of digital video, including several full EVAs with first person views for multiple crew members.

Book

After returning to Earth, this information was compiled into a 6x9 inch book (Figure 5.6), *Heading to Mars*, which was self published using the Espresso Book Machine at the University of Pittsburgh, ISBN 2810000150197. It can be printed at any time and both PDF and EPUB versions can be downloaded from my website: danomatika.com/projects/heading-to-mars. *Heading to Mars* was also featured in a 2013

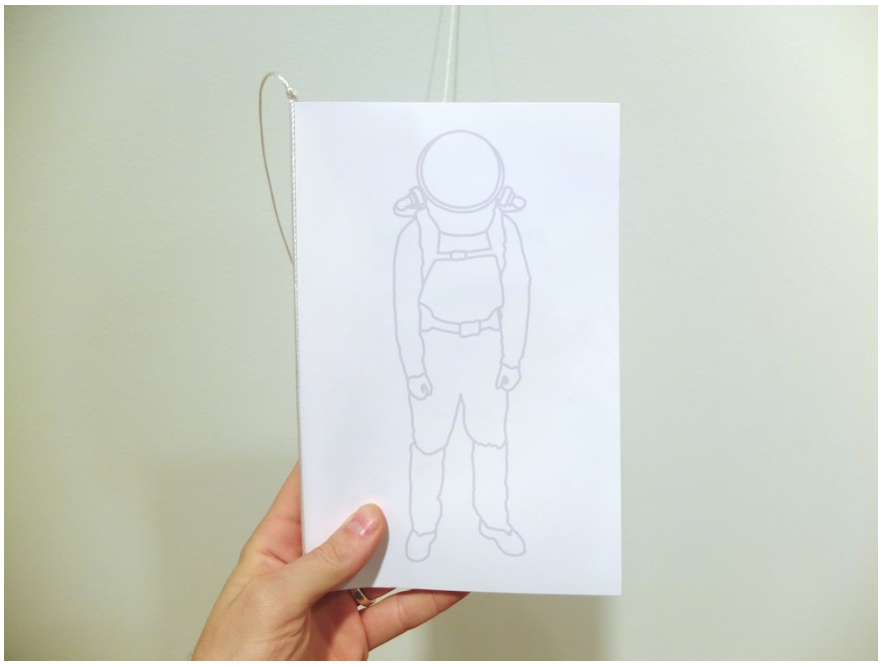


Figure 5.6: *Heading to Mars* 6x9 inch book

print ad for the EBM. (Figure 5.7)

The *Heading to Mars* minimal cover design (Figure 5.8) consists of two space suit line drawings on a grey background. The front cover is an MDRS sim suit while the back is an MIT Bio-Suit inspired compression suit mockup built as a prototype for *robotcowboy: Onward to Mars*. The compression suit didn't test well with audiences ("it doesn't look like a space suit"), so it was replaced by the second prototype, an MDRS sim suit-inspired design, for the show.

The following subsections contain excerpts from *Heading to Mars* arranged in chronological order. Tweets are begun with *"#MDRS"* hashtag and most chapters are listed by "Sol" which is a Martian day.

Training: Physical Training

> *Movement and agility exercises on simulated Martian soil. Before traveling across space, astronauts must train for the rigors of a hostile new world. [35, p. 12]*

Part of my preparation for the MDRS in November 2012, I conducted movement exercises on a stand in for the surface of Mars: the red clay soil of my hometown, Huntsville AL and location of NASA's Marshall Space Flight Center, the US Space & Rocket Center, and Space Camp. (Figure 5.9)

Figure 5.7: *Heading to Mars* in a print ad for the U Pitt Espresso Book Machine

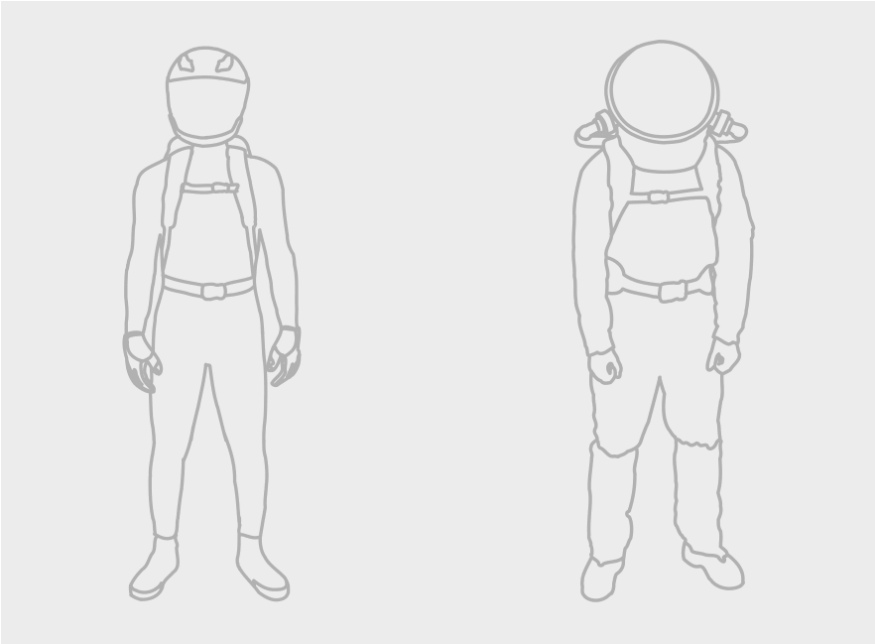


Figure 5.8: *Heading to Mars* cover design. Back (Left): MIT Bio-Suit inspired compression suit, Front (right): MDRS sim suit

Figure 5.9: Author's movement & agility exercises on simulated Martian soil

T-minus 2 days

> *It's weird to prepare for going to Mars the day before going, like going on a hike. [35, p. 19]*

Readying to leave for Utah, I was struck by how my everyday experience was about to transform into an extraordinary mission to Mars. I was committed to the simulation before I even left.

Sol 1

> *Journalist's Report*
>
> *Date: Sol 1 / Dec 1 2012*
>
> *Written by: Dan Wilcox*
>
> *After a bumpy entry through the Martian atmosphere, landing was A OK. After an initial inspection of the Hab systems and re-orientation to operating procedures (thank you Engineering Team!), the crew is ready for an extended stay on the red planet. [35, p. 24]*

Being the first crew of the season, the MDRS Engineering Team gave us the MDRS orientation and conducted the handoff of the station before returning to Earth. Once alone, we chose bunks and familiarized ourselves with all aspects of our new home on Mars, including our MDRS sim suits. I was an eager guinea pig and was assigned suit number 3. (Figure 5.10)

> *#MDRS Sol 1: Have suit, will travel. The music of Mars is decidedly Johnny Cash's "Walk the Line": thin, dry, & distant. [35, p. 23]*

Sol 2

> *Personal Notes*
>
> *I'm pushing for a long EVA, I mean one where I need to have a urine collection kit installed (which we have) [35, p. 28]*

Figure 5.10: The author with MDRS sim suit

Due to high winds, our first EVAs were cancelled, so we spent most of the day training and planning our EVAs for the next few sols. Going out on the Martian surface is not like simply bundling up on a cold day. Wearing a space suit and depending on limited resources means you need to plan and anticipate any problems which may occur, including the built in limitations of your own body.

Sol 3

> *Personal Notes*
>
> *mapping and naming are key, there is power in setting names, even though large features have been named remotely, local ones will be named by those who get there first [35, p. 38]*

Sol 3 was our first step on Mars, an exhilarating moment and beginning of the serious task of exploration. As per our mission goals, we scouted our immediate landing site and checked for any signs of damage to the HAB (Habitat module) exterior. Our movement tracks were recorded via Mars Positioning System (MPS) units for both mapping and the EVA mission report.

After living on a planet where most places have already been explored, it was quite amazing to feel that **no one** has ever stood on this spot before, **no one** has ever walked over that hill, and **no one** has ever seen this view before. It felt empowering and exciting to be in a position to both see and name landmarks.

Sol 6

> *#MDRS Sol 6: Roamed far and wide today but sometimes the best things are in your own back-yard, even on Mars. [35, p. 41]*

After our successful landing and first footprint on Mars, the next few Sols were spent roaming farther and farther from the HAB looking for suitable grades for future trails and roadbeds to new destinations. For the Sol 6 EVAs, we decided to forgo our rovers, stay purposefully close to the HAB, and focus on collecting rock samples for analysis by the Remote Science Team. Sometimes you can miss the important things in your own back yard.

> *Personal Notes*
>
> *my first shower on Mars … a short navy shower is all that's required, humans didn't bathe that much before 1900, but then again they didn't live in airtight tin cans either [35, p. 45]*

Resources are scare on Mars. Water and oxygen are collected from the atmosphere or sublimated from the permafrost around the landing site, but this takes time. We conserve and recycle every useful amount we can and this means no long, hot showers … ever. It's a waste of water and a waste of energy to heat said water. The simple solution is the "Navy shower", a staple of Earthbound submariners: on, rinse, off, lather, on, rinse, off. Our lightweight clothing is designed to wick away sweat and odor but, to some extent, the HAB will always be a locker room with multiple people sharing a relatively small space. Luckily, the human brain knows how to ignore certain smells after a while.

Sol 7

> *#MDRS Sol 7: Headed out today into the boulder fields east of Mars Base One. 20 mins of suit prep worth it every time. [35, p. 47]*

Figure 5.11: Crew 119 EVA Sol 7A suit donning. Habib Palenfo assists Lisa Stewart (foreground)

As we gained proficiency with our equipment, EVA suit up dropped from 40 minutes to 10 by the end of our mission. Even so, that time was always communal as it takes at least 1 assistant to help donning and doffing (Figure 5.11). What would seem like an ordeal just to head outside quickly becomes normal, just as one grows accustomed to putting on hat, gloves, boots, and a jacket come winter.

Sol 8

By now, life at the MDRS had become routine, from cooking with dehydrated food to writing mission reports every evening. So too had wearing the MDRS sim suits, so much so, that I felt it became a "second skin" and there was a moment where I forgot I was even wearing it:

> *Journalist's Report*
>
> *Date: Sol 8 / Dec 8 2012*
>
> *Written by: Dan Wilcox*
>
> *Now that we've been here 8 sols and gone outside on EVAs for 5, the old habits are setting in and my suit is again an extension of me, just a big dress suit in the business of exploring another*

planet. We were out today collecting soil samples of what appears to be a dried clay powder similar to bentonite on Earth and I placed my pen next to the sample point so it would be easy to tell in the photo how large the area was and what relative size the soil features are. When I picked it up to make notes on the location, heading, and MPS (Mars Positioning System) marker number, I noticed both my pen and notebook were covered in light red fines (very small particulate soil).

Naturally, I blew off the dirt and continued work.

And, naturally I suddenly felt pretty stupid when the inside of my helmet fogged for a second or two. [35, p. 52]

Sol 9

#MDRS Sol 9: This is a sol of rest. There will be no fashion for the New Martians. Only utilitarian waffle thermals. [35, p. 57]

Everything taken into space has a purpose. At this point in our technological development, we don't have the luxury of being able to take all of the extra stuff we may have on Earth with us. We have to stick to the essentials, which include clothing. After more than a week at the MDRS, I decided that there would be no fashion on Mars for at least a generation since you only need two garments: utilitarian waffle thermal underwear and a space suit. Or at least I do.

Personal Notes

would cannibalism be possible in a space crew on Mars? if we're pioneers, maybe we have to be ready when resources are low, think Donner Party or Andes Soccer team

we are here not for fame or glory but out of curiosity, we want to know, we want to explore, we are pioneers and we're doing it for all of humanity [35, p. 60]

Questioning resources, in my personal notes, I wondered if, under dire circumstances, how far astronauts would go to survive in a stark pioneer setting. At the same time, I was reflecting on the nobility of

the pioneer's efforts. In many ways, the first hand perspective was drawing up all sorts of questions that never would have occurred to me without it.

Sol 10

> *Journalist's Report*
>
> *Date: Sol 10 / Dec 10 2012*
>
> *Written by: Dan Wilcox*
>
> *As the power went dead, a cacophony of alarm buzzers went off and we all jumped from a sound sleep into crisis mode. Emergency heaters were activated, spare oxygen brought out, seals checked, and a power plan assessment survey mounted. Those of us not checking the energy systems went back to our bunks to stay warm. The Martian night is a cold one and it doesn't take long for it to seep into the Hab. [35, p. 62]*

As the old saying goes: you forget about what you have until you lose it. In this case, we had become complacent about our electrical power source as we were focused on the daily tasks at hand and the system had been working flawlessly. That is, until the early morning of Sol 10 when the MDRS power generator seized in the cold of the Martian night.

> *Personal Notes*
>
> *tracing the foot prints of other EVAs, maybe astronaut boots should have recognizable symbols of numbers to make it easy to tell who was there?*
>
> *taking the suit off is like meditation / a cool down period of simple maintenance [35, p. 64]*

The suits and the nature of our EVAs were constant themes in my notes.

The Apollo 11 live TV coverage revealed the difficulty of telling the astronauts apart and subsequent versions of the A7L moon suit incorporated red stripes for the commander. The Space Shuttle-era EMU suit continued this trend and the MDRS suits have their own version of this solution with red numbers sewn onto each backpack. This is perfect for recorded media, but not when following footprints, as we

ended up doing on one particular EVA. It made sense to me, then, that perhaps future suit designers could incorporate a number, pattern, or symbol on the soles of the boots in order to make footprints individually identifiable. It works for the Mars Science Laboratory. [38]

For me, the MDRS sim suit became my business suit for the job of exploring another planet. After each EVA, you carefully doff your suit, check your equipment, and prepare it for your next outing. This whole process is a cool down where you collect your thoughts in a quiet space after having been out in the open of a hostile environment.

Sol 12

> *Personal Notes*
>
> *found areas of what appears to be Gypsum within the clay, can be used for fertilizer, to make plaster, building material, component of Portland cement, will ask the remote science team [35, p. 74]*

Like the pioneers of old, the new pioneers will seek out discoveries and resources on the new frontier. During our scouting EVAs, we documented locations and took samples of various types of rocks and minerals in the region surrounding the HAB.

> *#MDRS Sol 12: Found petrified trees, fossils, and gypsum shale. Life and resources tied together through colored soil. [35, p. 69]*

Major discoveries for Crew 119 included finding areas of ice and liquid water in the Martian summer sun within a couple kilometers of the HAB and what could be fossilized animal remains from an ancient Martian seabed. The former is easy to confirm and we sent on photos of the latter to the Remote Science team for detailed analysis.

From sand, to water, to gypsum, to fossilized remains, to unusual rock formations, we collected as much data as we could to forward to the remote science team. Since the next shipment of raw material comes in the space of 2 years, it's best to plan on using what's around you.

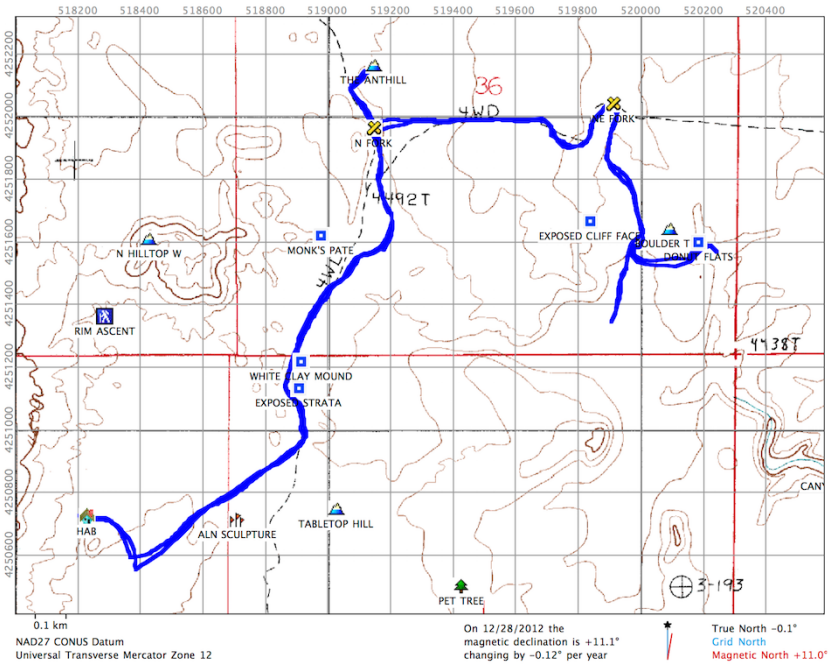


Figure 5.12: EVA Sol 5 B map by the author: an afternoon excursion for mapping possible future routes and points of interest (POIs)

Dec 15-16

> *#MDRS Sol 15-16: The Martian sky bids farewell. Orbital insertion was go & back on terra firma, but missing Ares. [35, p. 83]*

Our last day at the MDRS was spent packing up and handing over the station to Crew 120. It was a bittersweet time for us and an exciting time for them, but such is science and exploration: for every question answered, a new one awaits.

Mapping

Through mapping, my goal was to catalog our exploration and its focus on pioneering routes and resources.

I was involved in EVA route planning and the writing of the post-EVA mission reports. Each EVA included a "Mars Positioning System" device (GPS at the MDRS) recording our tracks and new terrain knowledge which I used to compiled detailed maps including landmarks, waypoints, and points of interest (Fig-

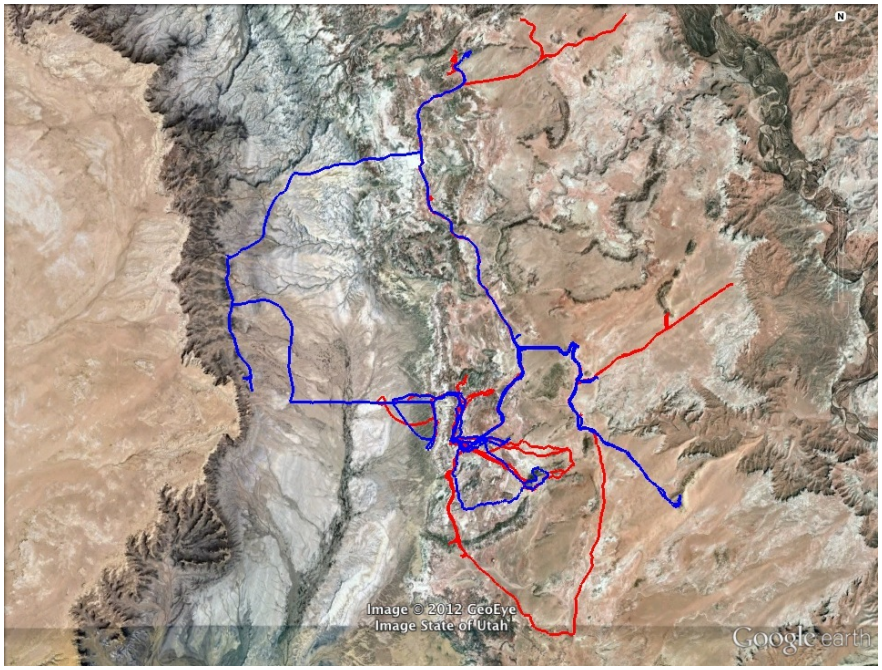


Figure 5.13: All Crew 119 EVA tracks with red for morning and blue for afternoon

ure 5.12). At the end of the mission, these new Points of Interest (POIs) were compiled into a separate *Crew 119 POI* document for use by subsequent crews and all EVA maps were merged into a single overall map colored by EVA time, morning or afternoon. (Figure 5.13)

Pigment Samples

On EVAs during Sols 8, 11, & 12, I collected soil samples to return with the "colors of Mars" for possible use as water color paint pigments. Each sample was taken following the basic MDRS geological sampling guidelines with notes on location, time, and photos of the sample area with reference object and orientation. (Figure 5.14)

All samples were compared (Figure 5.15) and compiled into the separate *Crew 119 Colors of Mars* report with 2 resulting color palettes: natural and saturation-enhanced to increase contrast. (Figure 5.16)

Figure 5.14: Colored pigment soil samples collected at the MDRS by the author. Each sample was documented with photos and a GPS coordinate.

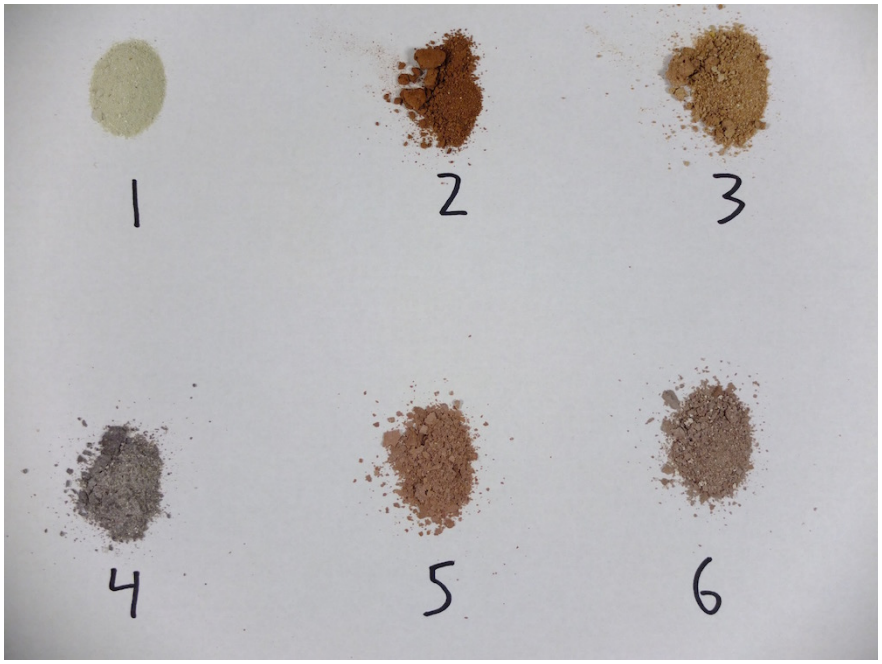


Figure 5.15: Pigment sample color comparison from the separate Crew 119 *Colors of Mars* report

Enhanced color	Normal color
Sample 1 #BDB58E	#A4A087
Sample 2 #7B301C	#6B371C
Sample 3 #A25F39	#8A6746
Sample 4 #7F726B	#756B66
Sample 5 #8C4E3F	#7F5748
Sample 6 #7B564D	#796154
Sample 7 #87774D	#7D7665
Sample 8 #86855A	#797B68
Sample 9 #393429	#4A473F
Sample 10 #1A1613	#292621

Figure 5.16: Pigment samples were averaged for color and compiled into a color palette table. The left column has increased saturation for better contrast. These are essentially a varied sample of the “colors of Mars” at the MDRS.

Crew 119 Mission Summary (Excerpt)

> *The crew of the Phoenix One successfully landed the first manned mission to Mars. Over the course of our 2 week stay, we have explored and mapped our surrounding area, found water on the surface, discovered microbial life, and identified numerous sites for study by future crews, shaken down systems, and conducted several human factors and engineering studies. We've proven that both living and working are possible on another planet and that we are not alone in the universe.*
>
> *As pioneers, every step we have taken at Mars Base One has paved the way for many crews to follow. [35, p. 84]*

Exhibition

Several months after returning to Earth, my MDRS book, photos, video, & pigment samples were part of the 2013 Master of Fine Arts graduate group exhibition [39] titled "Basement Miracle" at the Carnegie Mellon University Miller Gallery, March-April 2013. My presentation, *Onward to Mars*, was both documentation of my research experience as part of the MDRS Crew 119 and a lead in for the upcoming *robotcowboy: Onward to Mars show*. (Figure 5.17)

Research artifacts from the MDRS included a "Mars rock" sample (what exhibition about space would be complete without one?), 10 pigment samples in their collection bottles (Figure 5.18), and video of Crew 119 EVAs in the field provided by fellow crew member Habib Palenfo (Figure 5.19). Five photo prints were carefully selected to convey both the momentous nature of Mars exploration and the day-to-day reality of those on the ground through the contrast between my MDRS photography and the accompanying personal notes used for the captions (Figure 5.20). They were ordered chronologically, from training to landing to exploration to long night, an allusion to our small existence in the vast universe. (Figures 5.21-5.25)

Wall text for the *robotcowboy: Onward to Mars* show provided the basic "nutshell" idea: a one astronaut space rock opera about going to Mars. A large countdown clock ticked away the time for the theoret-

Figure 5.17: Heading to Mars exhibition presentation. “Mars rock” in the foreground, MDRS field photos on left, book & pigment samples back left, *Onward to Mars* text and countdown clock in the background, and MDRS field video back right.

Figure 5.18: Pigment samples in their yellow-capped collection bottles

Figure 5.19: MDRS field video excerpts by Habib Palenfo

Figure 5.20: MDRS field photos presented in the Heading to Mars exhibition. Each photo is accompanied by a quote from the author's journal.

Figure 5.21: Exhibition wall photo 1: “Astronauts must prepare for momentous, symbolic actions.”

Figure 5.22: Exhibition wall photo 2: “I forgot my towel. Douglas Adams would be disappointed.”

Figure 5.23: Exhibition wall photo 3: “Long EVAs require a urine collection kit.”

Figure 5.24: Exhibition wall photo 4: “Suit as second skin. Trying to blow dust off pen results in fogged helmet.”

Figure 5.25: Exhibition wall photo 5: “Early this morning the power went off. A stark reminder of how quickly we could disappear.”

ical blast-off of the show (Figure 5.26). In the end, this blast-off was delayed as the project was accepted for a grant as part of the Community Supported Art series at the New Hazlett Theater in Pittsburgh. [40]

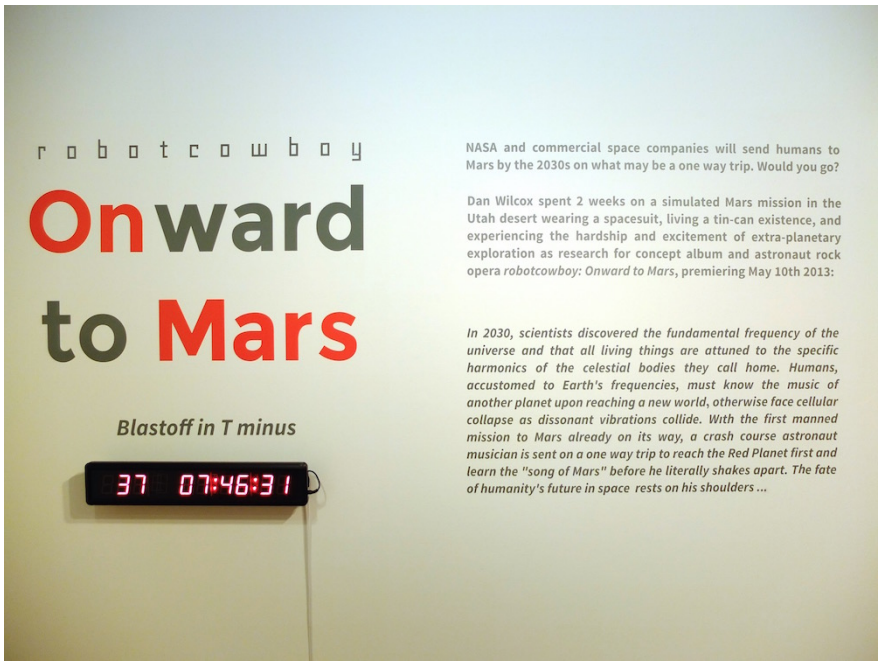


Figure 5.26: Exhibition wall text & countdown clock for the upcoming *robotcowboy: Onward to Mars* show

In all, the *Onward to Mars* exhibition was designed to showcase the MDRS and the experience of living and exploring another world as well as promote the work this research was directly informing, *robotcowboy: Onward to Mars*. For me, the 5 photo prints were the most important aspect of the presentation as they contrast our expectation of what a mission to Mars **should** be with what the day-to-day realities of such an endeavor might be: the noble goal versus the fact that astronauts wear diapers on space walks. As with other aspects of my work, it is this tension between the utopian ideal and our "squishy existence" that I find most interesting.

Pioneer Spirit

I applied to the Mars Desert Research Station, an analog simulation of Mars exploration in Utah, in order to get a unique perspective that I could use to develop my live show, *robotcowboy: Onward to Mars*. Through this experience and the reflection brought from compiling my notes, photos, and reports into the *Heading to Mars* book, the show now contains insight and material I would never have come up with via second-hand research alone … and then some.

I learned that being an astronaut involves lots of paper work, that dehydrated vegetables taste best for cooking if you've soaked them in hot water for at least 15 minutes, and that a space suit feels normal after only a few days. I learned to love the white noise of my oxygen supply, taking minimal showers, and sharing a purpose with strangers. I became acutely aware that the world outside our tin can wants to kill us, that resources are limited, and that a cold night is not when the generator should fail. I learned that fear will always be present for life in space, but that we have the training and the technology to be prepared for it. I know the pioneer spirit and the quest for knowledge will push humanity beyond its current limitations.

Sol 14

Look up into the sky, we're looking back. Join us.

Dan Wilcox, Journalist for Crew 119 of the Phoenix One, signing off. [35, p. 81]

6 Onward to Mars

> *Space became defined, crucially, as the environment we need technology to enter. - Nicholas de Monchaux in Spacesuit: Fashioning Apollo [19, p. 5]*

robotcowboy: Onward to Mars, is a one astronaut space rock opera influenced by the author's time at the Mars Desert Research Station. Begun in 2006, *robotcowboy* is an audio/visual performance platform using wearable computing with an emphasis on embodiment and action. *Onward to Mars* represents a new robotcowboy chapter with the focus shifted towards space and humanities future on the Red Planet.

How do you talk about going to Mars to a general audience on stage? Wear a spacesuit.

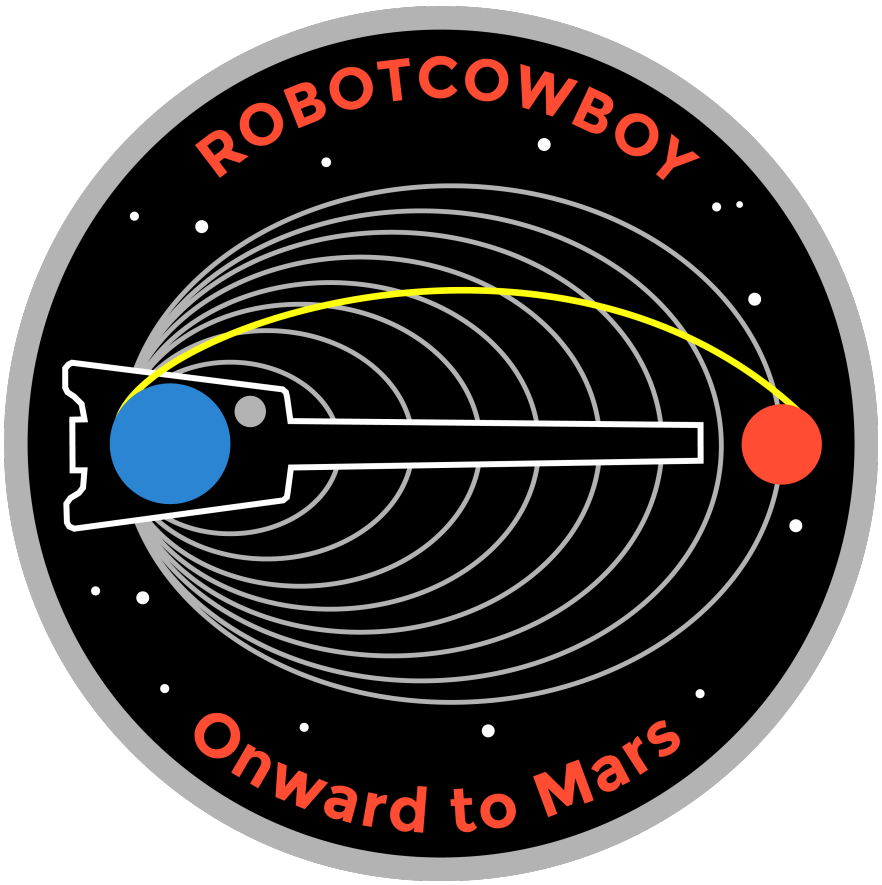


Figure 6.1: *robotcowboy: Onward to Mars* mission patch

robotcowboy: Cabled Madness

> *He was a completely self-contained one-man band, who played and triggered all of his music utilizing methods I had never encountered. … The songs were very structured and melodic, in a complex yet simple listening sense. His name, "robotcowboy", really fit the type of music he was playing. … I truly felt I was witnessing "The Future". Wow. - Christopher Miller, of Electronic Sub South, in a review of a tour show in Gainesville, FL Jan 23, 2008*

robotcowboy is a wearable computing platform to explore new types of man-machine music & artistic performance. Embedded computing, custom software, and audio electronics are utilized to build portable, self contained systems which both embed and embody the computation on the performer. This cyborg approach is both empowering and compromising as new sonic capability & movement are offset by the need for electrical energy: elements of tension between human and system. *robotcowboy* shows are always live and contain aspects of improvisation, feedback with the audience, and an inherent capability of failure, i.e. the "live" in live performance. [41]

The first incarnation of the project and result of my 2007 Master of Science thesis [17], now called *robotcowboy: Cabled Madness*, is a cyborg suit consisting of wearable computing & audio hardware mounted on a "Batman utility belt" and a working computer monitor helmet complete with built in camera and video goggles (Figures 6.4 & 6.3). Songs using this system are generally performed using USB HID (Human Interface Device) gamepads or digital guitar and are reliant on improvisational input & control. It could be said that these songs are "danced" as much as they are played. Control movements are visualized on the face of the monitor helmet, partially to emphasize the live nature of the performance as opposed to prerecorded playback. The fourth wall is always broken when audience members are required to help replace unplugged or missing connections in the "cabled madness".

The utopian cyborg suit was realized in a non-utopian manner with excess wiring and experimental software which might crash at any moment, requiring an invariable physical "collapse" while "rebooting". Oftentimes I had no control over this aspect of the system and would use the situation to my advantage.

Figure 6.2: *robotcowboy: Cabled Madness* performing at New Media Meeting 2009, Norrköping Sweden

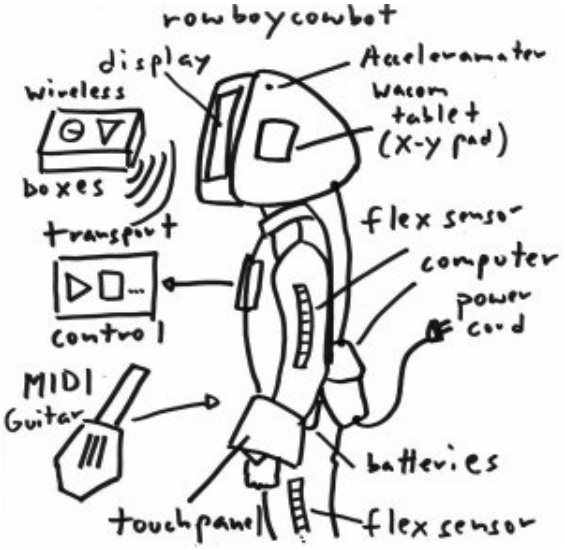


Figure 6.3: “roboycowbot” design sketch 2006

Even though the expected norm of the “musical performance” was interrupted, I continued to perform by playing with the notion of failure using an “infallible” computer. As with Tinguely’s *Rotozaza*, the 4th wall would be broken as former spectators became participants when they stepped forward to help me plug in a cable or point me in the right direction when the *robotcowboy* helmet camera was malfunctioning.

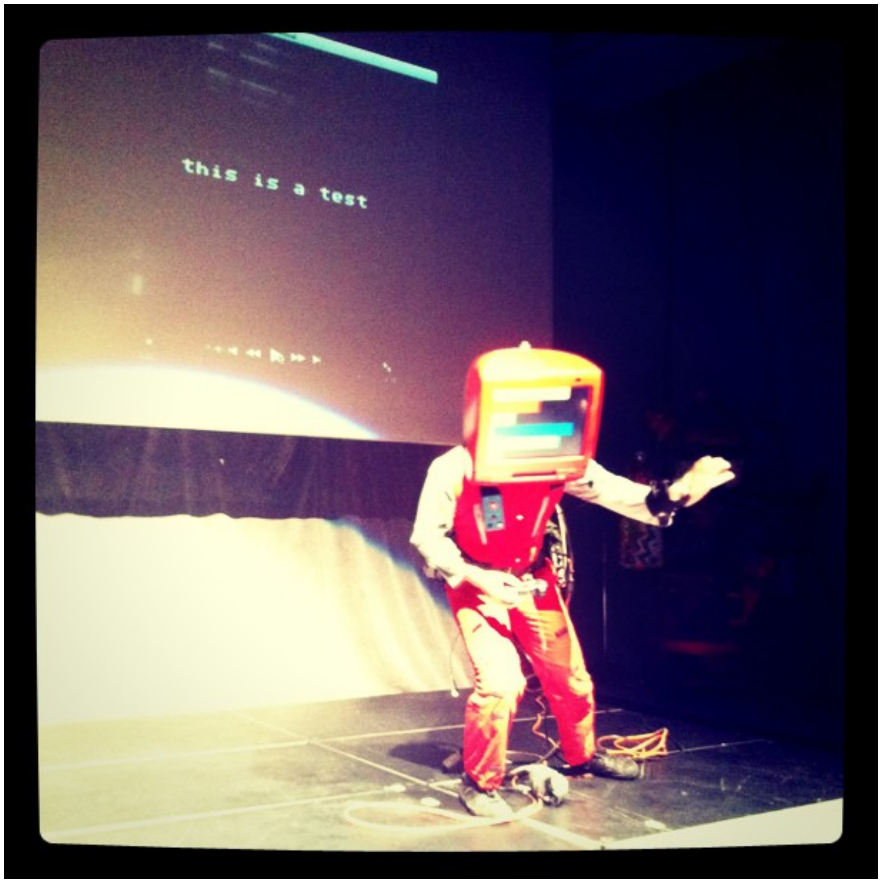


Figure 6.4: *robotcowboy: Cabled Madness* performing at the 1st Robot Film Festival 2011, New York

The digital revolution is over - Nicholas Negroponte 1998

Circa 2000, Kim Cascone coined the term “post-digital” to refer to an aesthetic in a world where digital technology has lost its utopian promise through becoming commonplace. He argues the “aesthetics of failure” are no longer to be ignored but highlighted and manipulated - new background sounds ala Luigi Russolo, musique concrète, and John Cage. [42]

The cyborg suit always dangled wires, its visual aesthetic derided by one online critic as looking like “some project from the 80s” - proof of the success of my choice of anachronism. The sound of *robotcowboy* embraces noise, glitch, and digital distortion where its beats are not rigidly timed and there is always an input for human error, adding salt to the man/machine mix.

robotcowboy: Cabled Madness performed at various music and art festivals in Europe and the US from 2006 to 2011, including a 2 month tour in 2008. The system and its design ideals of portability, ruggedness,

and plug & play were tested in the field and survived numerous shows in front of disparate audiences, from house parties to bars to art galleries to electronic music festivals. *robotcowboy* was always meant to be a platform to explore different ideas, however by 2009 it had solidified into a single act without a driving concept beyond the conceptual requirements of the system. It was time to look in a new direction.

robotcowboy: Onward to Mars

Figure 6.5: Apollo 11 astronaut Buzz Aldrin on the cover of the MIT Technology Review

It's been 45 years since the last Apollo astronauts left the moon and Buzz Aldrin laments on the cover of the MIT Technology Review (Figure 6.5): "You promised me Mars Colonies. Instead, I got Facebook." [43] If we didn't go then, why don't we go now?

For the next *robotcowboy*, I returned to my childhood interest in spaceflight and researched contemporary space programs and near future plans for planetary exploration which mostly lead to Mars. The Moon is closer but less interesting for colonization since it doesn't have an atmosphere to hold in heat and useful gases. Venus has the opposite problem with the densest atmosphere and highest temperature of the interior planets, not to mention its sulfuric acid clouds [44]. Next up is Mars.

Of the planets in the Solar System, Mars is an ideal candidate for long term human habitation. It's smaller than the Earth with a surface area roughly the size of all of Earth's continents combined and 1/3rd the gravity. It has a lighter atmosphere consisting mostly of carbon dioxide which keeps it warmer than the airless vacuum that is the surface of the Moon. Water exists at its north pole in the form of ice and evidence exists for water trapped in permafrost [45]. You couldn't go chipping ice blocks in your T-shirt, but you could wear a lighter weight atmospheric suit instead of a full space suit.

Mars is relatively close and we've gotten pretty good at landing things on it. Its only some 35 million miles away at its closest and manned missions would take roughly 6 months to reach it, which is the next block over in astronomical terms and doable with current technology. Heavy lift rockets such as the upcoming NASA Space Launch System (SLS) or the SpaceX Falcon Heavy could send a small crewed vehicle to Mars in one launch. [46]

Sending a crew is possible, we're just missing the will. For many people, a mission to Mars is only within the realm of science fiction, even though it could have been a reality decades ago. At the same time, NASA has plans for Mars in the 2030s [47] and private organizations such as Mars One want to start colonization in the 2020s [48], so this could be something we'll all be watching live on TV in the near future.

With this in mind, I decided the new *robotcowboy* would head to Mars. The cyborg suit becomes a space suit and the wearable computer is now built into the life support system backpack: the cyborg is now an astronaut. This new show is designed to convey the realities of a contemporary Mars mission through

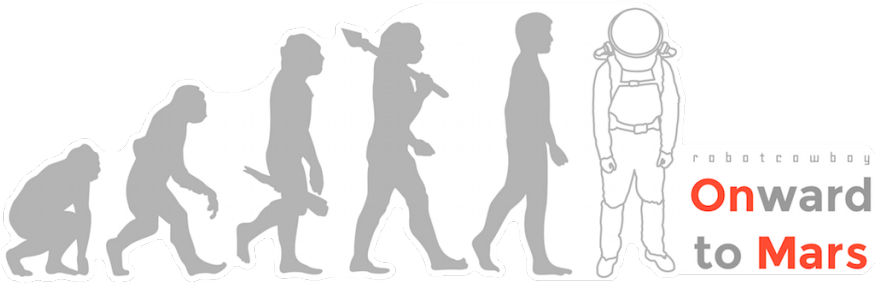
performance and music in order to bring this discussion to new audiences and is directly informed by my "feet on the ground" research conducted as part of Crew 119 at the Mars Society's Mars Desert Research Station (MDRS). The basic pitch is: "DEVO and Laurie Anderson meet Carl Sagan on the Red Planet." The show's name, *robotcowboy: Onward to Mars*, is adapted from the "To Mars! To Mars! Onward to Mars!" greeting of engineers in the 1930's era Soviet Group for the Investigation of Reactive Engines (GIRD) [49] and used by members of the Mars Society which I picked up at the MDRS.

(For detailed information on my MDRS research, see the previous section on *Heading to Mars*)

Crossing Lines

Conceptually, this new show is designed to contrast the expectation of space flight and its utopian ideals with the day to day reality of such a mission to the Red Planet. As postmodernist theorist Jean Baudrillard says of the space race [50], the interest for most people in landing a man on the Moon was not in the event itself or the fulfillment of some dream, but with the "perfection of the programming and the technical manipulation, by the immanent wonder of the programmed unfolding of events." I feel that the sheer routine of sending people into space since Apollo 11 has both lessened interest into the mundane aspects of space and increased our desire for another utopian mission, except now this utopia feels unattainable. I hope to show to a general audience that such a mission is not only possible but that the day to day work involved is both exciting and worth backing.

robotcowboy: Onward to Mars is about crossing lines. In leaving this planet as a species, we'll be crossing a line for the first time since we started walking erect, using tools, and created civilization thousands



robotcowboy: Onward to Mars bumper sticker

of years ago. Similarly, with this show I hope to encourage my audience to cross a line in their view toward a contemporary mission to Mars: that it would not have to remain in the world of science fiction, but could cross over into reality if we have the will to do, as Kennedy said, “something hard”.

Influences

> *If we are going to move human beings into outer space, you are going to have to move their culture with them. - Lowry Burgess [51]*

In addition to research spent at the MDRS, *robotcowboy: Onward to Mars* is influenced by space art, contemporary artists working with space themes, the space operas of classical composers, and the musical vibrations of Sun Ra.

Roger Malina, astrophysicist and editor of *Leonardo: Journal of the International Society for the Arts, Sciences and Technology*, defines Space Art as “contemporary art which relies on space activity for its implementation” and further states that the “creation of contemporary art is inextricably tied to the process of creating human civilization.” In this light, he feels that art making in space should not only be encouraged but that human culture in space would be incomplete without it. [52]

The origins of Space Art coincide with that of the Space Age of the 1960s when the predictions of science fiction became reconciled with that of science fact, where art in space moved from imaginary to contemporary. The 1962 inception of the NASA Art Program brought artists such as Norman Rockwell, Nam June Paik, and Robert Rauschenberg into the agency to explore the cultural impact of space exploration [52]. Artists unofficially hitchhiked to the Moon with the *Moon Museum* etching (Figure 6.6) allegedly hidden in the Apollo 12 Lunar Excursion Module [53] and *The Fallen Astronaut* sculpture brought as part of Commander Dave Scott’s personal effects on Apollo 15. [54]

With the development of the Space Shuttle program in the late 1970’s and 1980’s, artist Lowry Burgess worked with NASA to develop rules allowing for non-scientific payloads and personnel policies, resulting in the 1989 launch of Burgess’s *Boundless Cubic Lunar Aperture* onboard Space Shuttle Discovery during STS-29 [55]. After the end of the Cold War, access to space began to open up with works such as Arthur

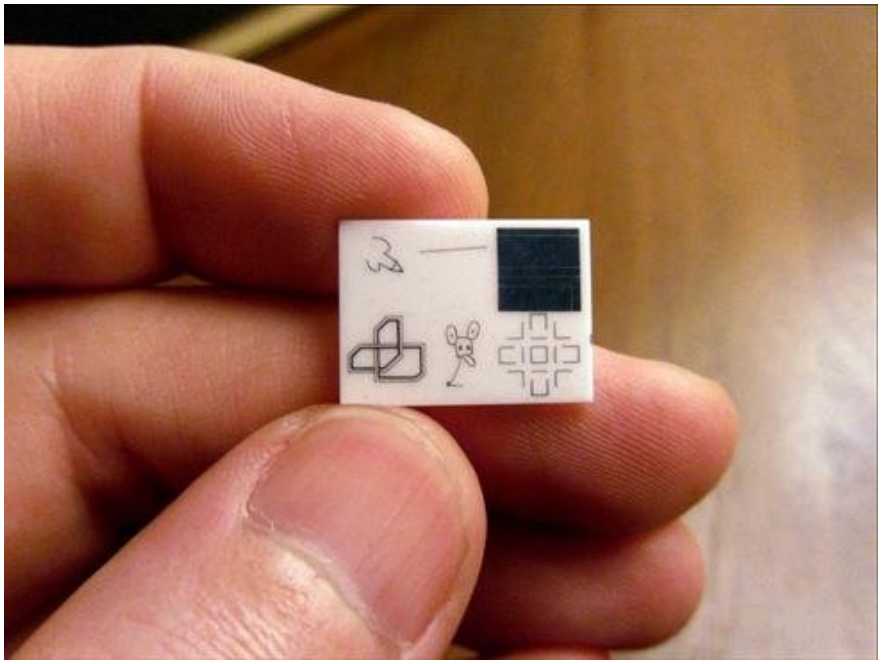


Figure 6.6: A *Moon Museum* ceramic wafer, one of which was allegedly concealed in the Apollo 12 Lunar Lander *Intrepid* and left on the Moon

Woods' *Cosmic Dancer* sculpture being carried to the Mir space station [56] in 1993. Similarly, artists began to engage with zero gravity including Frank Pietronigro's "drift paintings" [57] and choreographer Kitsou Dubois's dance experiments onboard parabolic jet flights. [58]

On the ground, contemporary artists, as with popular culture, have been utilizing space themes, imagery, and data. More recently, self-described "bricolage artist" Tom Sachs' 2007 *SPACE PROGRAM* recreates the Apollo 11 landing in the art gallery and the subsequent *SPACE PROGRAM: MARS* in 2012 portrays a fictional Apollo Mars landing (Figure 6.7) through meticulously crafted space suits, vehicles, and tools using common, everyday materials [59]. Similarly, Peter Hennessey's life-sized replicas of the Apollo Lunar Rover, the Hubble Space Telescope, and the Voyager spacecraft are "an investigation into a class of objects that we can see but cannot touch" yet ironically, have a "large presence in the world". [60]

In the realm of music, artists have long explored space themes from Mozart's Magic Flute and Joseph Hayden's *The World in the Moon* to Gustav Holst's *The Planets*.

I'm looking for answers in the entire universe because I want to know the real potential of man.

- Sun Ra [61]

Figure 6.7: “Astronaut Eannarino and the Handtool Palette Carrier (HTC)” from Tom Sachs’ 2012 *SPACE PROGRAM: MARS* live exhibition and performance

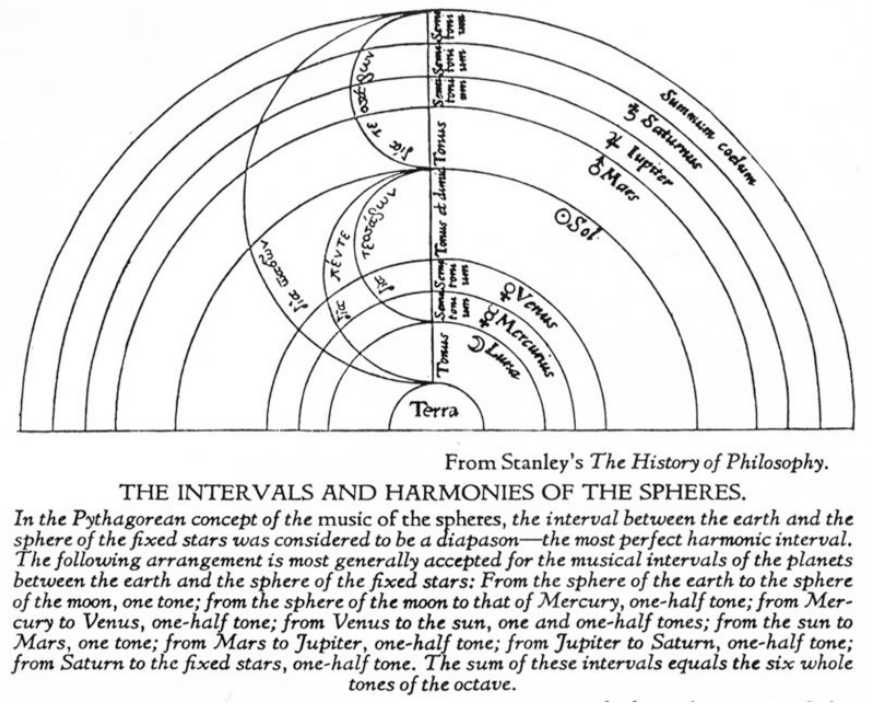
Experimental jazz composer, band leader, and performer Sun Ra’s work routinely called to space travel and astral projection through sound, dissonance, and harmony. Open to investigation into new modes of expression, he was one of the first musicians to experiment with synthesizers in jazz. He created his own afro-future mythos based on ancient Egypt and space travel with his band, the Sun Ra Arkestra (and its many variations), spreading his message through their sonic vibrations.

Story

It was 2030 when we discovered the fundamental frequency of the universe.

tuning fork rings

From this tone can be constructed the harmonics of life, death, and movement in the cosmos. Although, we can so far only comprehend one billion billionth of the available data, we do know that each celestial body sings its own song and those who wish to live upon a new planet’s surface, must know its melody by heart.



From Stanley's *The History of Philosophy.*

THE INTERVALS AND HARMONIES OF THE SPHERES.

In the Pythagorean concept of the music of the spheres, *the interval between the earth and the sphere of the fixed stars was considered to be a diapason—the most perfect harmonic interval. The following arrangement is most generally accepted for the musical intervals of the planets between the earth and the sphere of the fixed stars: From the sphere of the earth to the sphere of the moon, one tone; from the sphere of the moon to that of Mercury, one-half tone; from Mercury to Venus, one-half tone; from Venus to the sun, one and one-half tones; from the sun to Mars, one tone; from Mars to Jupiter, one-half tone; from Jupiter to Saturn, one-half tone; from Saturn to the fixed stars, one-half tone. The sum of these intervals equals the six whole tones of the octave.*

Figure 6.8: *musica universalis* or "Music of the Spheres"

The story for *robotcowboy: Onward to Mars* follows a single astronaut on a one way trip to the Red Planet. In the near future, it is discovered each celestial body emanates harmonics on the newly found fundamental frequency of the universe related to their electron cyclotron resonances. Particles rotating within magnetic and gravitational fields generate unique frequency patterns related to both this fundamental and that of the body itself, forming a fingerprint or "song". Life on each planet evolves to the frequencies of its home and must adapt if it is to live on a new world or perish. Specially trained, the Astronaut is sent ahead of an existing crew with "scientific (musical) instruments" in order to discover the "song of Mars" and ensure the success of the following landing and colonization efforts.

Although the show is a contemporary hard science fiction mission to the Red Planet, one conceit of fantasy was chosen to explain the nature of the "solo one way trip": the Astronaut is the pathfinder to discover the "song of Mars". Providing the basis for the narrative action but not directly referenced within the show, the concept of "planetary frequencies" is influenced by the Age of Enlightenment *musica universalis* ("universal music") theory that postulates each planetary body in the solar system moves in a perfect harmony related to intervals within the Pythagorean musical scale (Figure 6.8). Backing this up is a small

amount of scientific fact in the Jupiter electron cyclotron emissions detected by the Voyager 2 plasma wave instrument in 1979:

> *Jovian electron cyclotron emissions are intense narrow-banded emissions, generated by energetic electrons spiraling along the magnetic field lines of Jupiter and its magnetized moons. The frequency bands of the electron cyclotron emissions occur at harmonics or very precise multiples of the electron cyclotron frequency, a characteristic frequency of the plasma surrounding the planet. - University of Iowa Radio and Plasma Wave Group [62]*

Synopsis

The show itself is a concept album with each song being a thematic part of the narrative. Song titles appear in *italics*.

Pre-Act: Press Conference

Press conference on the mission in the theater lobby with small stage, table, curtain, and projection. One interviewer, a camera or two, and the Astronaut. End with open audience question and answer session.

Act 1: The Trip

Three month trip to Mars with backstory only explained through preceding press conference and context within the show. First 1/3 of the stage acts as the interior of the Habitat (Hab) which spins via pendulum action from the weight of the stage 3 rocket booster on the end of a tether. Discussion and songs of the excitement & isolation of the journey. (Figure 6.9)

Song 1, *Instrument Calibration*: noisy introduction played with gamepad, simulates show instrument calibration in a manner similar to a pre-flight checklist

Song 2, *Wanting the Universe*: opening rock theme played on guitar, establishes overall premise of heading to Mars

Figure 6.9: Act 1: Landing sequence. The author is wearing a blue NASA flight suit with custom astronaut wings and mission patch.

```
put me on a rocket
out into space
give me a chance
to move the human race
out to the stars
we'll start on Mars
and go from there
```

Song 3, *Traveling*: voyage to Mars improvised on gamepad, accompanies spoken word sections on distance, isolation, and expectation

Song 4, *MartianPlain*: rock landing sequence played on guitar, acts as climax of Act I

```
I've traveled 40 million miles
will I make it?
braking burn completed
orbital insertion begun
```

Figure 6.10: Act 2: Spaceman Caveman, a song of evolution.

```
aerobrake deployed
we've got to try
all I can do is try
```

Act 2: Exploration & Discovery

Transformation from traveler to explorer within inflatable space ship, stage right. Don space suit (as second skin) stage center and embark on first EVA. Feelings of excitement and discovery: walking on Mars! Move to scientific investigation and preparation where high technology sends a human to Mars in order to dig in the dirt: “Spaceman Caveman”. (Figure 6.10)

Song 5, *Suit Donning*: a set of generative sequences that provide atmosphere for the donning of the space suit, controlled by gamepad (Figure 6.15)

Song 6, *Spaceman Caveman*: rock song noting the simultaneous triumph and irony of the first steps on the Red Planet, the highest technology on Earth allows the Astronaut to dig in the soil of Mars like a caveman

```
I'm a spaceman caveman
all the way from earth
```

Figure 6.11: Act 3: Cold Martian night. The Astronaut is using a replica penetrometer musical controller.

```
I'm a spaceman caveman
now I'm digging in the dirt
I'm a spaceman caveman
can life be found?
I'm a spaceman caveman
evolution's come to town
```

Act 3: The Song of Mars

The frequencies begin to manifest themselves as the Astronaut moves farther from the Hab. They then appear as 3 challenges: radiation, a 30 mile high dust "devil", and the cold night (Figure 6.11). Overcoming these challenges yields the Song of Mars.

Song 7, *EVA*: a set of sequences which explore and confront the dangers of the Red Planet in order to find the "song of Mars", performed on Theremin & integrated penetrometer gamepad

Song 8, *Night*: loss, isolation, and doubt in the cold Martian night, suit life support shutting down, recog-

Figure 6.12: Video stream snapshot of the audience members using white LED lights as stars seen by the Astronaut on stage during Act 3.

nition of the missing piece of the "song of Mars", reflection of audience members as stars in the universe through a suit mounted camera (Figure 6.12)

Song 9, *Ball of Love*: celebration and finale performed on guitar, life support kicks in and completion of the mission

Spoken Word

The story and thematic content of *robotcowboy: Onward to Mars* are conveyed through spoken word segments by the Astronaut, an archetypal "everyman" character. Inspired by the work of performance artist Laurie Anderson, the Astronaut delivers his point of view as the narrative progresses, noting both positive and negative aspects of the experience. Although presented in an ostensibly theatrical setting, the spoken word in *robotcowboy: Onward to Mars* is delivered directly to the audience in an improvised manner without following a strict script in order for the performer to better play off of timing and audience feedback. This approach also helps to "keep things live" in the *robotcowboy* conceptual tradition.

This content of the show is gathered from research and my own aforementioned personal experience at the Mars Desert Research Station. Sources include Dr. Robert Zubrin's *The Case for Mars* [46], the history of Soviet and NASA missions to the Red Planet, Mars in popular culture and science fiction, Martian plan-

etary exploration data (size, gravity, weather, etc), long term space strategy via the Rockwell Integrated Space Plan [63], the Mars One project [48], NASA's Apollo project, various space travel and human physiology studies, popular views of contemporary space exploration via media and online commentary, and first woman in space Valentina Tereshkova's affirmation that she would go to Mars "without coming back." [64]

Music

> *The sound is meant to be gritty, noisey, and melodic. Unlike the cold precision of most electronic music, care has been taken to incorporate the frailty of the live human performer. Live musicians make mistakes and this fact adds an element of excitement to the music. robotcowboy songs are thus constructed using parts generated in realtime as the performer plays. - robotcowboy: Cabled Madness presskit 2008*

The music of *robotcowboy: Onward to Mars* is a combination of computer music and rock & roll which has been described as "experimental pop". As with the previous *robotcowboy* incarnation, composition is focused on live performance and experimental in nature. Some songs are performed much like "digital jazz" through free improvisation with custom controllers and digital instruments while the rock songs are played using voice and guitar along with pre-sequenced bass and percussion voices.

Musical development of the show is inspired by a number of composers and musicians. The space-themed operas of Haydn & Mozart lend to the overall thematic arc of the show. The conceptual and experimental sound of 50's and 60's electronic composers Delia Derbyshire, Pauline Oliveros, and Louis and Bebe Barron showed how simple instrumentation approached with experimentation and a conceptual backing can lead to new and interesting soundscapes. Sun Ra's afrofuture space jazz and performance aesthetic opened new doors: "We've tried the possible, its now time to try the impossible" [65]. Finally, the pop/rock stylings of DEVO, the Talking Heads, the B-52's, the Cramps, and the surf rock band Man or Astro-man? (sic) directly inform the musical and performance aesthetic for the rock songs within the show.

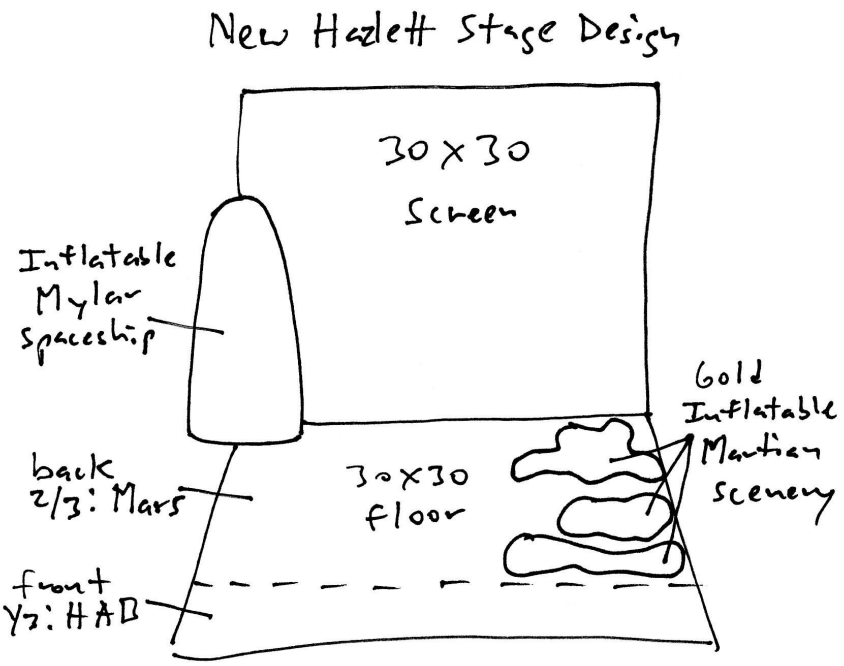


Figure 6.13: *robotcowboy: Onward to Mars* stage design (from audience) at the New Hazlett Theater, Pittsburgh, PA

Visual Design

An important aspect of this new project over the previous *robotcowboy: Cabled Madness* is the development of a coordinated design based on a conceptual backing. Like NASA's Apollo project and contemporary space programs, the visual design for *robotcowboy: Onward to Mars* was approached with the ideal of practical, functional, detail-oriented engineering.

Stage, Lighting, & Projection

As with the previous incarnation of *robotcowboy*, the *robotcowboy: Onward to Mars* show is designed to be performed in a variety of venues, with our without lighting and/or projection. For the initial show at the New Hazlett Theater in Pittsburgh, however, we had access to a large, open, and reconfigurable "black box" space with stadium seating and decided on a "minimal-maximal approach": minimal stage & lighting elements combined with the large area, scenery, and projection. The 30x30 foot floor space is divided from front to back with the first third being the interior of the Habitat and the back two thirds being the Martian

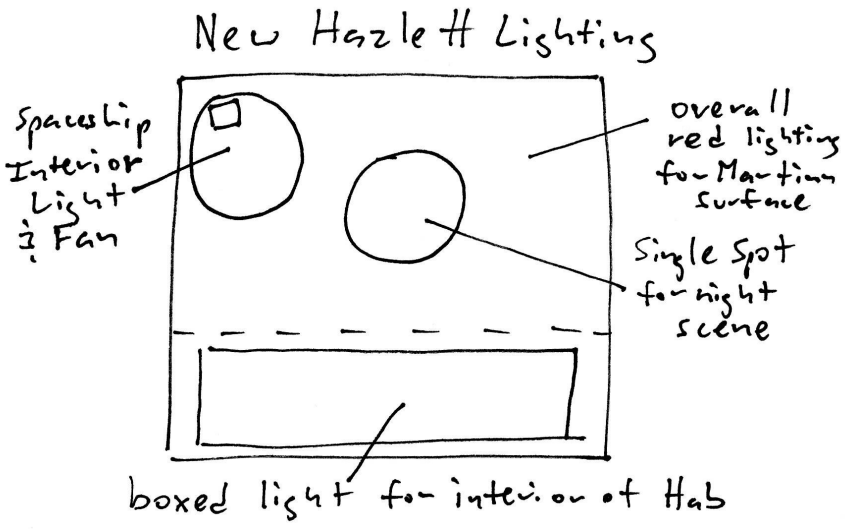


Figure 6.14: *robotcowboy: Onward to Mars* lighting design (from above) at the New Hazlett Theater, Pittsburgh, PA

surface with red floodlights. This division highlights the proxmimity of the Astronaut to Earth with the actor's proximity to the audience: closer and confined while on the journey to Mars, then farther & free once on the planet's surface. The back wall is a 30x30 foot projection surface lowered flush to the floor to create a seamless horizon which matches the floor space and give the audience a sense of overwhelming immerison. Inflatable sculptures made of silver and gold mylar were built by artist and collaborator Anika Wilcox to serve as scene elements, with a 16 foot tall & 8 foot in diameter silver rocket nose cone / space ship stage right and a set of smaller golden "blobs" to depict Martian topography stage left. Anika had worked with Mylar in previous projects and it was chosen as a representative "space age" material resulting in lightweight, easily transported, and redeployable sculptures. (Figure 6.13)

Lighting is kept minimal (Figure 6.14) and is designed to emphasize both the movement and distance of the journey, literally from the audience's point of view. The front third of the stage signifying the Hab literally boxes in the Astronaut by masked, rectangular light. During the first act, the back two thirds of the stage are kept black aside from the projection, further isolating the Astronaut. The transition to the second act moves from the front Hab space, through the silver inflatable space ship on stage right, to the Martian surface on the back two thirds of the stage. This action is facilitated by the donning of the space suit. As the journey to Mars unfolds in Act 1, a remotely-controlled fan slowly inflates the spaceship and

a small lamp lights the rocket from within during the transition from Act 1 to 2 (Figure 6.15). During Acts 2 and 3, the back two thirds of the stage are flood lit with textured, red light to create the Martian surface (Figure 6.10). A single center stage spot light is used for the final scene where the Astronaut confronts the cold Martian night, creating a single small point within a surrounding blackness. (Figure 6.11)

Small white LED lights are distributed to audience members at the entrance to the theater and a set of TVs on stage show the live feed from a wireless camera backstage facing forward. After the suit donning procedure, the camera is attached to the suit to provide a first person perspective of the Martian EVA during Acts 2 & 3. As the stage lights dim into a single spot during the cold night section of Act 3, the Astronauts asks to see the rising of the stars provided by the lights of the audience which is shown through the video feed from his viewpoint. The audience then becomes the universe as the Astronaut returns from the cold in order to signify both our own individual cosmic insignificance as well as our connectedness as a people willing to support the Astronaut from afar. (Figure 6.12)

The show's systems design continues my approach from *robotcowboy: Cabled Madness* where a wearable, embedded computer system provides the audio and control for a separate laptop running projected background and visuals. This digital projection is generated by custom software on the large 30x30 foot back wall screen and acts as a virtual backdrop. Providing both context and scenery, it's purpose is both to help inform on the action taking place (the Hab tumbling through space during the journey) as well as provide changing large scale scene elements (planetary landing, Martian landscape, and approaching dust storm). (Figure 6.16)

The show is established with a large star field from the Hubble Space Telescope, "diagnostic text" for checking show audio systems, and the mission patch for the intro song. Act 1 provides imagery for the journey to Mars including multiple looping video clips of the HAB rotating on its tether as it travels, HAB interior views, the approach to the Martian landing site, and overflight landscape views from orbital data. Acts 2 and 3 share large-scale landscape views, many of which originate from the NASA Mars Pathfinder and Curiosity rover missions. An animated evolution scene in Act 2 backdrops the song "Spaceman Caveman" and Act 3 features backdrops for the 3 enemies of life on the surface: cosmic radiation, dust storms, and

Figure 6.15: The Astronaut within the silver mylar inflatable spaceship on stage right during the transition from Acts 1 to 2. With the stage lights off, the mylar is translucent when lit from within showing its internal golden color.

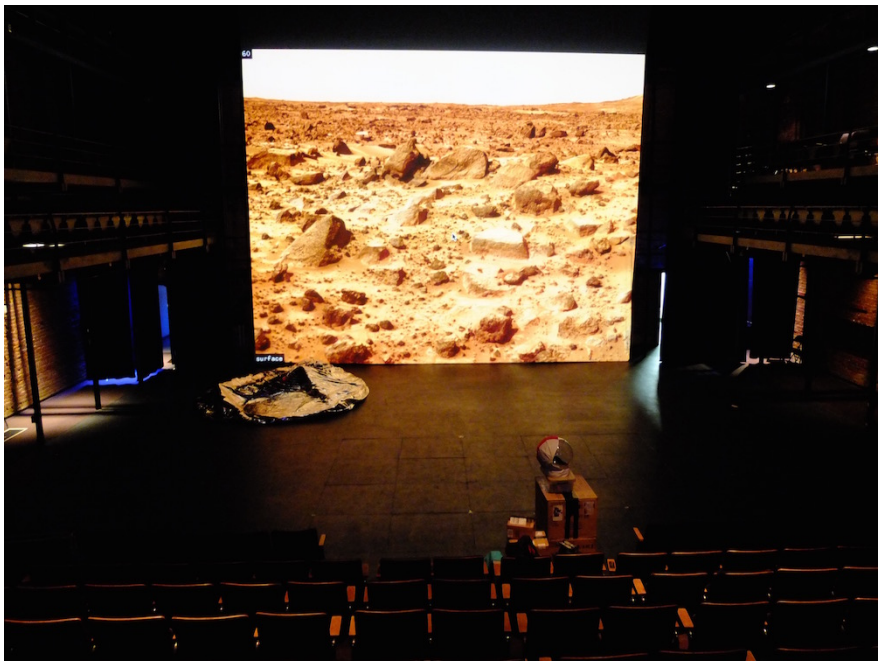


Figure 6.16: *robotcowboy: Onward to Mars* projection test (from audience) at the New Hazlett Theater, Pittsburgh, PA. Note deflated silver mylar space ship on left.

the cold of night. The show ends with a rotating animation of the Red Planet taken from space by one of the Viking orbiters for the song “Ball of Love”.

This scene imagery is generated by “Visual”, a custom software application written for the show in C++ using the OpenFrameworks arts-engineering toolkit. “Visual” is the next generation of the “rc-visual” application used in *robotcowboy: Cabled Madness* and can show images, movies, and dynamic programs written in the Lua scripting language within separate scenes. Transitions and scene element properties can be controlled dynamically over a wireless network connection for distributed control from the PASS backpack.

Color & Typography

Lines are clean and the color palette consists primarily of white, gray and black with bright orange functioning as a highlight (Figure 6.17). The reason space craft are mostly white and black is simple: white reflects energy while black absorbs it. Reflecting the sun’s radiation in zero gravity helps your spacesuit passively regulate heat while a black heat shield helps concentrate energy on the bottom surface during

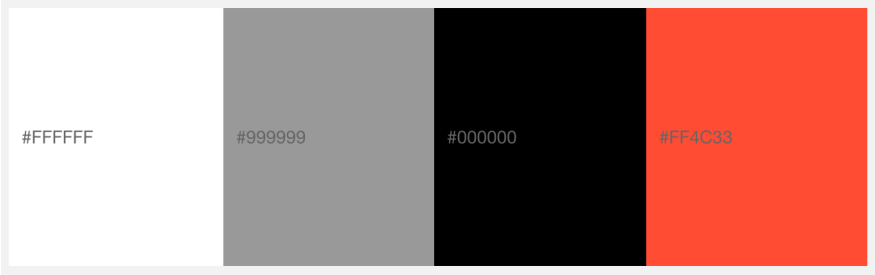


Figure 6.17: *robotcowboy: Onward to Mars* color palette, inspired by NASA and contemporary space programs

Figure 6.18: *robotcowboy: Onward to Mars* sample typography

reentry. Also, high contrast color choices are important in extreme lighting swings where a white object reflecting sunlight stands out against the blackness of space.

Similarly, typography for the show follows clean contrasting lines with round bold headings, modern thin-weight body text, and an angular vector font for “robotcowboy” to imply the technical nature of the platform (Figure 6.18). A typographical logo was also made using these fonts with contrasting grey and orange, where the orange highlights “On Mars” within the show title “Onward to Mars”. (Figure 6.19)

Mission Patch

Every great mission needs a patch. Influenced by Apollo, Soyuz, Space Shuttle, and International Space Station patch designs, the *robotcowboy: Onward to Mars* mission patch consists of only a few main ele-

Figure 6.19: *robotcowboy: Onward to Mars* typographical logo

ments: the Earth, the Moon, Mars, and the outline of a guitar on a sparsely starred black background (Figure 6.1). The Earth & Moon are within the guitar outline on the left which represents both the spacecraft and "scientific (musical) instruments" used in the show. A yellow line signifying the journey connects the Earth to Mars on the right. A series of cosmic vibrations emanating from the guitar outline on the left also connect with the Red Planet and represent the goal of discovering the "song of Mars". The text "robotcowboy" is centered along the top and "Onward to Mars" is along the bottom with both following the curve near their respective edges.

Suits

> *I have a symbiotic relationship with my spacesuit. I take care of it, and it takes care of me in return. - astronaut Don Pettis [66]*

The space suit is an icon in a show about space travel and exploration. As such, work on the *robotcowboy: Onward to Mars* suit began before the show had a story or a name. A prototype initially explored a "new space" compression suit design and the second, final suit design combines an MDRS sim suit approach with the Apollo moon suit. A blue NASA flight suit is worn during the press conference and Act 1 while the space suit is worn during Acts 2 & 3. A headset microphone is used with both suits throughout the show.

Figure 6.20: MIT Professor Dava Newman modeling the Bio-Suit compression atmosphere suit

The transformation and suit donning sequence are an important aspect of the show as living and working in space revolves around this ever-important “miniature habitat”.

Flight Suit

Accompanying the space suit for the press conference and HAB interior scenes in Act 1, the Astronaut wears a blue NASA flight suit complete with astronaut wings name tag and *robotcowboy: Onward to Mars* mission patch. (Figure 6.9)

Suit 1: Bio-Suit

Figure 6.21: Preliminary *robotcowboy: Onward to Mars* Bio-Suit replica test sleeve with grey stitching and accessories.

The first prototype was modeled after the futuristic Bio-Suit from Professor Dava Newman's group at the MIT Man-Vehicle Laboratory [67]. Grandchild of NASA's Space Activity Suit research [68], the Bio-Suit is a compression-based suit designed for a partial-pressure atmosphere like that of Mars. Unlike traditional suits, it is not a full pressure "balloon" but an elastic compression garment with stitching in all the right places to "keep you from exploding" (this is the author's colloquial explanation). The wearer would be able to have much greater fields of motion at much less expenditure of energy as compared to pressure suits and less oxygen would be needed since only the helmet would need to be pressurized. (Figure 6.20)

In modeling the Bio-Suit, a suitable looking helmet with an open face profile was obtained and and a test sleeve was made which replicated the stitching patterns and padding as shown in the prototype Bio-Suits. Further, other off the shelf accessories were assembled along with color palette tests: a gray stitching on white background design with an orange highlight. (Figure 6.21)

Appearance-wise, this suit design is more streamlined and form-fitting than NASA's Apollo A7L moon suit or the Space Shuttle EMU suit. Unfortunately, the desire for a "new space" suit design for the show ran against the expectation of the audience. When tested at the *Heading to Mars* exhibition, the feedback

Figure 6.22: Preliminary white Bio-suit replica with grey stitching and zippers

on the first *robotcowboy: Onward to Mars* prototype suit was that it “doesn’t look like a space suit” and instead reminded people of either pajamas at worst or a motorcycle suit at best (Figure 6.22). Obviously, neither of these fit the very iconic role of “space suit” within the show and, although some elements could have been refined further, it was decided a different approach was required.

Suit 2: MDRS Suit meets Apollo

Figure 6.23: The author during a helmet and backpack fitment test for the second suit inspired by the MDRS and Apollo

For the next suit, we decided to go for a more "traditional" design by adapting the Mars Desert Research Station sim suit and its recognizable "bubble helmet" (Figure 5.2) with the large backpack and color scheme of the Apollo A7L moon suit. By going more bulky, this new suit reflects the expectation of the viewer ("that's a space suit") while providing an emphasis on itself as the Astronaut's second skin. As with the MDRS sim suit, the donning & doffing procedures are simple yet still require a certain number of steps which I feel are important to demonstrate in order to convey the transformation required for an EVA with current technology.

With information from the Mars Society[1] and my own firsthand notes while wearing an MDRS sim suit, this new suit was designed in a similar fashion: bubble helmet with locking collar strapped to a backpack worn over a jumpsuit with gloves and boots. The helmet is fabricated from two nested 14" clear acrylic spheres with the outside covered with fabric to approximate the A7L's visor assembly cover (Figure 6.23). The jumpsuit is white and patterned after the A7L Integrated Thermal Micrometeoroid Garment with extra layers and pockets added to provide a simulation of requisite bulkiness. As an amalgam of past & current NASA suit designs, it has red "Commander Stripes" similar to those on the later Apollo lunar missions (13-17) [69] and both the EVA and American flag shoulder patches found on the Shuttle EMU. The NASA "meatball" logo and *robotcowboy: Onward to Mars* mission patch flank the crewman name tag sewn to the chest flap. The gray and white Bio-suit inspired prototype is reused as the Liquid Cooling Garment worn under both the A7L and EMU suits. (Figure 6.24)

PASS Backpack

Complementing the *robotcowboy: Onward to Mars* suit itself is the MDRS sim suit and Apollo inspired PASS (Personal Audio Support System) backpack. More than a physical stand-in, the backpack is the heart of the live performance and contains an embedded computer and audio interface. Like the suit, its size and appearance are modeled on both the MDRS sim suits and the Apollo PLSS (Personal Life Support System). (Figure 6.25)

[1] MDRS sim suit design help from Judd Reed and Shannon Rupert

Figure 6.24: The *robotcowboy: Onward to Mars* space suit in action. The song transport control box is mounted on the left backpack shoulder.

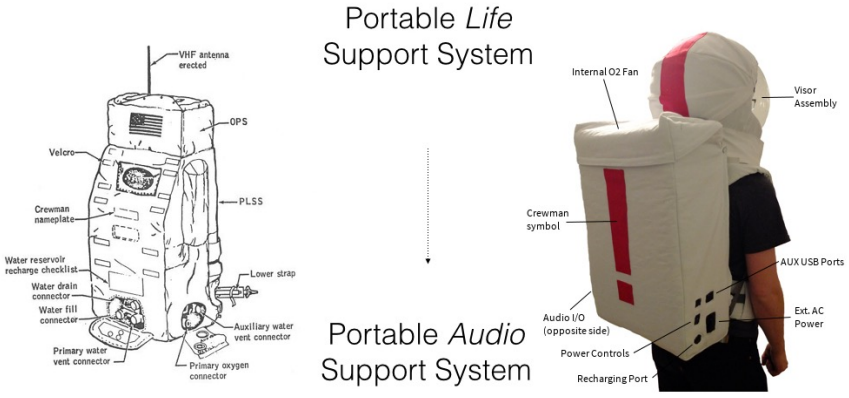


Figure 6.25: Apollo PLSS influence on the robotcowboy PASS Backpack

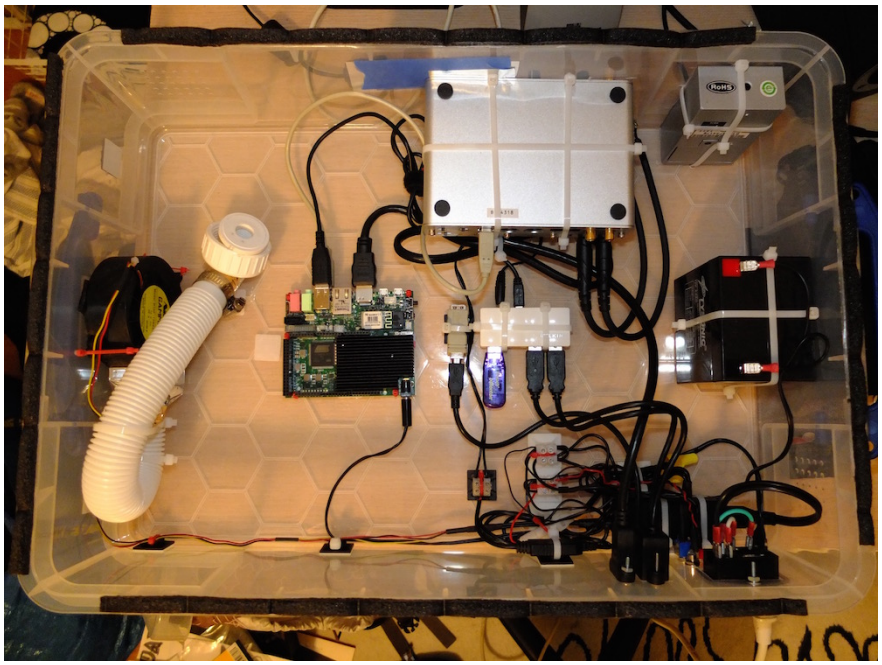


Figure 6.26: *robotcowboy: Onward to Mars* PASS backpack internals: airflow fan (far left), UDOO embedded computer (center left), white USB hub (center right), silver Roland Edirol UA-25EX USB soundcard (center top), silver Behringer DI Box (top right), 4 Ah lead acid battery (right), and the power/charging system & controls (bottom right).

Airflow

The MDRS sim suit backpack is covered in a thick quilted material and contains fans and a battery to provide airflow into the suit helmet through 2 flexible PVC tubes. This is important for 2 reasons: 1. to immerse the wearer within the sound of their air supply; 2. to keep the helmet from overheating and fogging up. The onboard battery also stands in as a consumable resource to represent the life-support system in a real suit. When your fans stop, you're out of oxygen. Similarly, the *robotcowboy: Onward to Mars* backpack contains a battery, fan, and tubing to provide much needed airflow to keep the helmet clear during the performance.

Embedded Computer System

The embedded computer system runs GNU/Linux, the open source Pure Data audio DSP environment, and custom software for handling USB gamepad & MIDI interfaces. Control data is routed bother internally and with the external laptop using the OSC (Open Sound Control) networking protocol. For *robotcowboy:*

Onward to Mars, the utility belt of the previous *robotcowboy* incarnation has become the space suit backpack: the Apollo PLSS (Portable Life Support System) is now the PASS (Portable Audio Support System). In fact, the functional requirements of both systems are similar: self-containment, portability, and ease of use. This approach continues the fundamental *robotcowboy* project requirement for wearable, embedded computing for performance while matching the thematic elements of the show's concept.

The old wearable computer from *robotcowboy: Cabled Madness* has been replaced with a 4 core 1GHz ARM UDOO embedded computer. A lead acid battery, charging system, and the aforementioned helmet airflow fan have been added ala the MDRS sim suit backpacks. The battery allows the system to run for up to 4 hours, enabling a more realistic, cable free performance. (Figure 6.26)

Software-wise, the system is nearly identical to the *robotcowboy: Cabled Madness* setup: Debian GNU/Linux, Pure Data & custom software daemons to handle control device hot plugging. All audio DSP takes place in Pure Data, an open source object oriented graphical patching environment developed by Prof. Miller Puckette at UCSD and international community contributors. The main Unit-Control Pure Data "patch" handles networking, playlist control, and audio output. Songs are written as separate patches which are loaded through the playlist and started and stopped during the performance by a physical control box on the front of the suit. All mixing is done in software and down mixed into a stereo signal for both the performance PA and live WAV file recording.

Scientific (Musical) Instruments

In *robotcowboy: Onward to Mars* the Astronaut utilizes a set of "scientific instruments" to detect the song of Mars and explore its landscape. Some stand in for existing devices while others are repurposed musical instruments, the main goals being to include both varied control for the solo show as well as directly reflect both physical tools and the essence of the data they are to measure or control.

Gamepads

Gamepads have been a natural interface for *robotcowboy* since the beginning of the project. They are ubiquitous, cheap, and provide a large number of digital and analog IO in a small package while using the standard driverless USB HID (Human Interface Device) protocol. They can be easily hacked and embedded within other devices and/or connected to new switches or sensors to create entirely different physical interfaces. For instance, the "button box" playlist and song transport control interface used in *robotcowboy* and mounted on the PASS backpack shoulder strap in *Onward to Mars* is a plastic case with buttons connected to the logic board of a gamepad housed within, its original purpose redefined by a different single purpose interface design. (Figure 6.24)

One major addition to *robotcowboy* in *Onward to Mars* are wireless Playstation 3 controllers using the Bluetooth radio protocol. Many *robotcowboy* songs use a digital instrument written in software mapped to the physical interface of a dual analog thumbstick gamepad which provides natural 10 finger control over 4 voices (thumbstick x & y), percussion (up to 4 parts), and tracking control (voices or percussion) [17]. Previously, these songs required physically hot plugging the gamepad during the show which can break up the action, especially when trying to insert the USB plug backwards! This was part of the show which helped break the fourth wall and emphasized the man/machine hybridity of the *robotcowboy: Cabled Madness* performer. In *robotcowboy: Onward to Mars*, however, the spacesuited Astronaut utilizes appearingly well-designed and overly-tested aerospace "hardware" thus the now seamless transition through the use of wireless controllers.

A white PS3 controller acts as the main instrumental interface for Act 1 and the transition scene to Act 2. This color was chosen to match the color palette of the space suit and other equipment.

Cosmic Ray Detector

The "Cosmic Ray Detector" in *robotcowboy: Onward to Mars* is an electronic musical instrument called a Theremin which uses the body's capacitance to ground to sense the movements of the player's body in space. Named after its inventor Leon Theremin, the instrument is literally "played on the ether" using the

Figure 6.27: Theremin in use as the “Cosmic Ray Detector” during Act 3

proximity of the hands to two antennas which control the pitch and volume of two heterodyning oscillators. Its sine wave-like tone and glissandi became a staple of 1950s science fiction movies.

What better instrument to detect invisible radiation than one that is played via unseen control? The Theremin in the show is painted white and features a blue NASA “meatball” logo to give it an official look. It is used in an exploratory sequence that detects and measures cosmic radiation on the Martian surface. The Theremin audio output is mixed into this song and drives other digital software instruments, signifying the hidden effects of radiation. (Figure 6.27)

Penetrometer

A soil penetrometer is a simple geological instrument that measures soil compactness. We used one at the MDRS and I later recognized the same instrument in photos of the Apollo program on the Moon. Nominally consisting of a shaft that is driven into the ground and a dial indicator with two handles on the end, this tool would be one in a standard set used by extra-planetary geologists on the Red Planet.

For *robotcowboy: Onward to Mars*, the penetrometer symbolizes a human connection to the “mars” (what would a Martian word for “earth” be?) and is used to probe the Martian regolith and sense wind frequency during the dust storm sequence. A replica constructed out of wood with an integrated wire-

less Playstation 3 controller between the handles, it streams its accelerometer position and orientation to control several digital instrument voices that reflect the motion of stabbing and sensing the soil. These motions and voices are then used to harmonize with the dust storm as it approaches. (Figure 6.11)

Guitar

I have been playing the 6 stringed electric guitar for a number of years. A natural interface within *robotcowboy*, it provides a more one-to-one audiovisual performance feedback with the audience as compared to digital instruments. For me, it is important that the project has a "slippery element" to the instrumentation as opposed to complete sequencing of sound. A clean ideal meets the loud messiness of the electric guitar in order to both provide a needed edge and human element.

In *robotcowboy: Onward to Mars*, the guitar plays a central role. Combined with the space suit, it is a symbol of the musical style and performance aesthetic of the show and its outline is featured on the mission patch. A headless guitar with a simple, straight design was chosen in order to remove the symbolism already associated with popular guitar styles and imply a more generic, futuristic, and non musical instrument (Figure 6.24). The guitar is used to perform roughly half of the songs and is played through a single analog distortion circuit which is plugged into the PASS backpack's USB audio interface. Digital software effect processing is then added on a per song basis and includes delay, reverb, and/or chorus. At the end of Act 3, the guitar brings the Astronaut back from thermal shutdown during the cold Martian night and is used to play the "song of Mars" in the finale: *Ball of Love*.

First Show

The show was selected for the first annual Community Supported Art (CSA) series at the New Hazlett Theater in Pittsburgh, PA with the show date of February 8th, 2014. Work began in the fall of 2013, although preliminary design and research had taken place on and off since the Summer of 2012. Access to the performance space opened in January 2014 and main rehearsals took place the week before the show.

My wife, artist Anika Hirt, provided assistance for the costuming, scenery, and graphic design and the

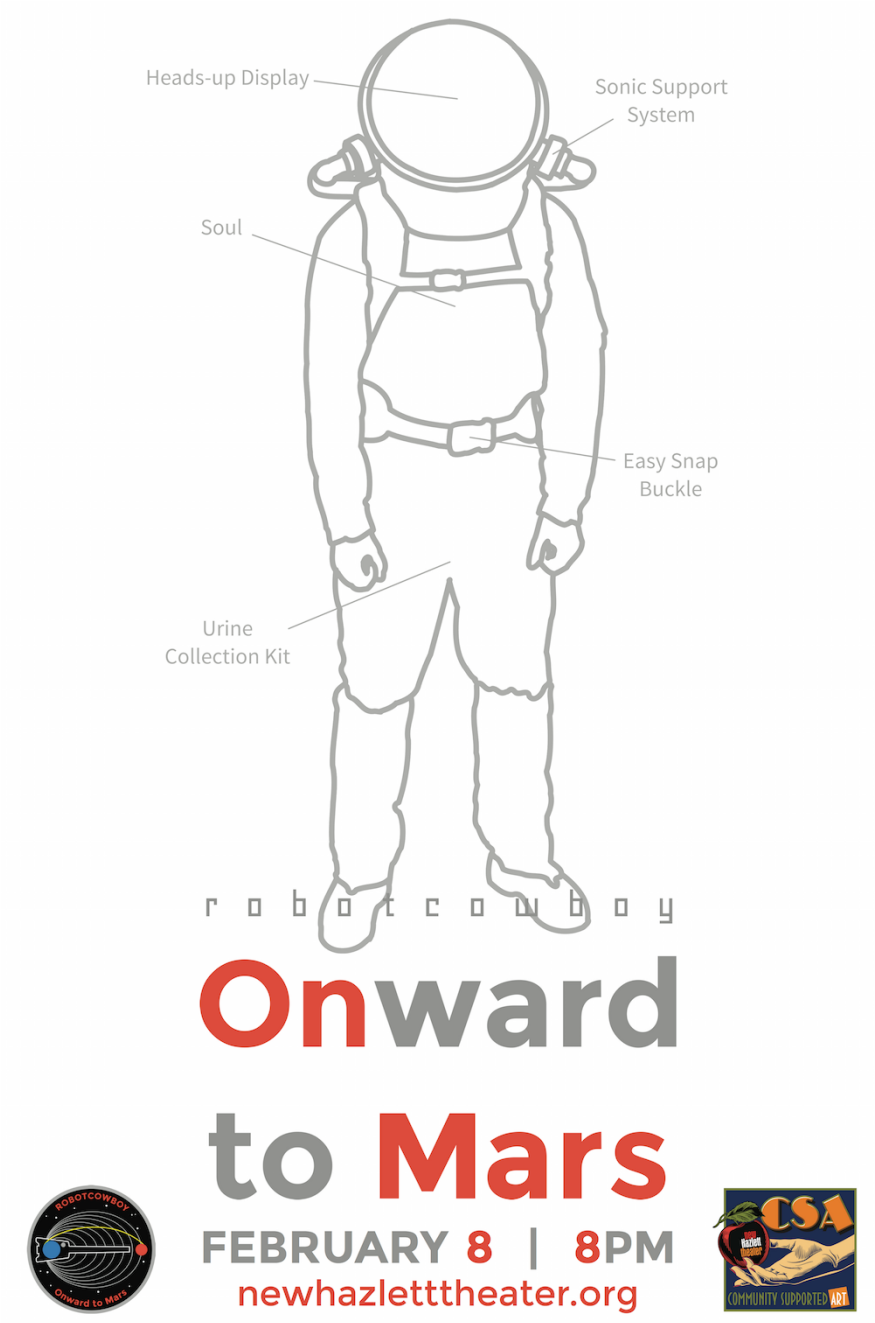


Figure 6.28: *robotcowboy: Onward to Mars* first show promotional poster

show was facilitated by the gracious staff of the New Hazlett theater who handled promotion, lighting, and sound. It received online and print promotion with posters put up across Pittsburgh (Figure 6.28) and played to an audience of about 100 people.

Reception

> *My friends – the astronomers and Mars researchers – who came to see the show all had mixed reviews. Good and bad. But damn if we weren't talking about it all night and even the next morning. - J. Storey, New Hazlett Theater*

Overall, the show went well despite some last minute hiccups including a coffee spill on the laptop providing the visuals. The script was simplified from the original scope of the background research into a more focused presentation. The costuming and scenery were more highly developed while the music and visuals were not taken as far as originally planned. Simply put, the project was perhaps too much to "chew" at once, especially by a single artist used to working alone. In this respect, the first *robotcowboy: Onward to Mars* is more of a draft show rather than a completely finished piece, the first iteration in an ongoing process.

The audience was able to follow the story through the spoken word and projection elements, as evidenced from my own observation and feedback with audience members. I feel the press conference really helped set both the tone as well as narrative before the show even began. Ushers quickly gave out the over the 100 white LED "stars" which reappeared when the Astronaut pointed toward the audience and said "it's a clear, cold night and the stars are coming out". A major point of laughter came from an improvised line that "dust devil" is quite an inappropriate term for a 30 mile tall tornado. It's one thing to see it from orbit and quite another when it's headed straight for you!

The immersion of the Astronaut into the space suit worked well and really brought the audience into the idea of the "second skin". Due to the difficulty of donning the suit, a helper assisted the Astronaut as it was deemed more important to maintain the flow of the show than to break the illusion of a "solo journey". The wireless audio system and suit battery allowed for complete autonomy for the audio system

allowing effective use of the entire stage. One minor problem that occurred during the performance (and not during the rehearsals!) was that the cooling airflow tube from the PASS backpack was pinched during the suit donning, so the helmet fogged up during the singing portions of Acts 2 & 3. It literally became a one astronaut terrarium (Figure 6.24). Like any R & D project, future work will involve making sure problems that arise during testing will be corrected for repeated iterations.

The main goal of *robotcowboy: Onward to Mars* is to get people thinking about contemporary space exploration and a mission to Mars, not as science fiction but as a reality. Beyond the journey and "flag planting" event, it is intended to present a fictional story but with a real world perspective from the point of view of the Astronaut who asks questions that challenge the audience to contemplate the personal, profound, and absurd nature of a future in space: "Would you go?", "Would you go if you couldn't come back?", "Are the risks worth it?", "What if we find life?", "How does our place in the universe change?", "Is this an evolutionary step?", and "What does humanity on Mars mean to me?" In creating this show, I wanted to bring this discussion out of the scientific and space communities to the larger public without any concrete answers, of which there currently are none.

I knew my goal was reached when the audience left the theater talking amongst themselves, debating whether or not they would personally go to Mars, and discussing points and asides made by the Astronaut. I received messages for days afterward from people who said they were still thinking and talking about aspects of the show which, I feel, demonstrates that they were presented with new insight and perspective. Despite the unfinished nature of this first performance, it was a complete success.

> *I don't know what people are saying about Saturday's show. This mission to Mars was not my first Hazlett rodeo, obvi, but it took me the farthest. … all 8 of us saw something totally original, exploratory, inspiring, unprecedented, etc, …: a fully expressed creative vision! I was rapt! I have a vague, untested sense of myself as creative, and Saturday both squashed and expanded what that word even means to me. Six out of the eight of us, (the other two were more interested in hockey, and that's fine too) young, idealistic, mostly employed by non-profits around town, were blown away by the true value of local theater. Give one brilliant artist/engineer a gor-*

geous space, high A/V technology, mountains of transparent foil, total creative license, and an audience with no preconceptions to muddle the thing whatsoever, and boom! Onward! - email excerpt from D. Madden, Onward to Mars audience member

Wear A Spacesuit

Whether humanity heads to Mars in 2023 or in the 2030s or 40s, this is something that should and will happen. It is important for those outside of the space, engineering, and scientific communities to think about what this means to them and society in general as a landing on the Red Planet will impact culture as much if not more than Apollo 11's *Eagle* touching down on the Moon. Created through research, the artist's MDRS experience, and experimentation, *robotcowboy: Onward to Mars* hopes to open up these questions to a new audience. An evolution in the *robotcowboy* project, the first show achieved this goal through a conceptual basis and synchronized music, spoken word, and design which will be further refined and developed into the future.

How do you talk about going to Mars to a general audience on stage? Wear a spacesuit.

Future

In the future, I plan to take *robotcowboy: Onward to Mars* on tour. It is designed as a modular performance that can take place on and off a theatrical stage and most of the physical gear and software system are currently in place. Thanks to the support of the New Hazlett, I have photos and live video in a professional setting in order to market the show.

In the meantime, I plan to revisit the music and visuals in order to make a greater connection between the two and update the thematic and atmospheric elements of the show. Much of the music was not developed as far as I feel it needs to go, so that will be a main focus. I might also look into adding one or two more exploration tools / musical controllers in order to expand the initial landing portion of Act 2.

For me, the show itself is not the extent of the entire project, but one branch from my research and time at the Mars Desert Research Station. This theme of contemporary space and exploration will lead to new songs, shows, and performances. Like *robotcowboy: Cabled Madness*, I will take it as far and as long as it needs to go, utilizing it as platform for dialog into contemporary space issues. *Onward to Mars* is not a singular show but a metaphor to be explored with new audiences in diverse venues. I also look forward to a returning focus on my performance practice and musical experimentation without the pressure of feeling I need to conform to a studio or gallery artists world. The future is bright and there is plenty to do.

Conclusion

Eadem mutata resurgo (although changed, I arise the same)

I applied to the Carnegie Mellon Master of Fine Arts program because I knew there were "things which must be made" which I could not articulate except through intuition and iteration. I was able to achieve more than a few projects by simply "doing" but, by the time I applied, doing was not enough. I could not explain my own motivations for the work I produced and I knew I needed to go deeper. Something was missing which, having an engineering background, I had not fully considered or appreciated: an artistic focus.

My three years at CMU were not easy. I tried new things, negotiated dense and unfamiliar philosophy and art theory, came to understand what a critique was, and failed a number of times. In fact, upon graduation in 2013, I felt my time at CMU was an expensive mistake. However, with a little distance after 2 years and now that I have been moving forward and starting over, I feel it was a difficult process because growing is a difficult process. My shell was too small, so I had to cast it off and grow anew.

In writing this thesis, through a combination of previous artist statements and introspective texts along with a little wisdom after 2 years, I can trace a clear extension of the foundation I laid with my M.S. thesis, *robotcowboy*. This project forms my attitude and approach to performance. Now, 8 years later, this M.F.A thesis builds upon this need for embodiment and liveness with a conceptual interest in Research and Development. Upon realizing my practice is the combination and collaboration of 3 identities, I recognize this inherent struggle as the fruit for creative anachronism, new expression, and new growth.

At this point, I feel I have successfully achieved the main goal for which I pursued an Master of Fine Arts: a conceptual base. I am now more in touch with who I am and my own interests and motivations. I feel I have the foundation for a life long art practice.

I'm not an Astronaut, but I play one on TV.

Back-up LMP Jack Schmitt carries the scoop with some very non-lunar foliage in the background. Photo filed 22 July 1971. - NASA

Appendices

Geometry and Non (Venice Mouth poem)

This is not a true poem and, it is to my understanding, a mistaken amalgamation of several existing works by Jennifer Scappettone. Since this was provided to us as source material and was used in the Venice Mouth project, I am including this text.

And a girl converted to colorism out of Venice returns as if in a dream to its marriage with the linear abstraction of an ideal maturity.

Where does it lie, nella vita attuale nowadays: in the performers or their onlookers & ubiquitous multiform recorders?

Its plastics in the off-season left orphan, mute against the Adriatic without their hippies.

Inside: being itself a twist, Tiepolan, and comment on the vagrancy of water in this loose cosmopolis.

Robot Rumble Script

MilBots: autonomous military robots (largely US)

HELPERS: helper and nursing robots (largely Japanese)

Intro

Cue *Intro music*

ANNOUNCER welcomes and introduces the teams: HELPERS & MilBots

ANNOUNCER: “Let’s get ready to rumble.”

Crusher vs RIBA

Chars: CRUSHER, RIBA

ANNOUNCER: Our first match is a test of might and agility between two unlikely opponents. Nursing arms versus crushing tires, brains versus brawn, David versus Goliath, RIBA versus CRUSHER.

ANNOUNCER: In this corner, a veteran of the squared circle, weighing in at over 6 tons and completely autonomous, the unmanned ground machine most likely to commit vehicular robo-slaughter … the CMU CRUSHER.

Cue *CRUSHER intro*. CRUSHER comes bursting out as the intro plays. He rounds the ring and acts aggressively towards the audience, mock-charging them.

CRUSHER: Rawwrg. Yeah Yeah. That's right. It's Crushin' time!

ANNOUNCER: In this corner, sporting long arms for patient care, a unique anime appearance, representing the HELPERS in her Robot Rumble debut … the Japanese nurse robot RIBA.

Cue *RIBA intro*. RIBA comes out slowly as her intro plays. She goes out into the crowd and tries to shake hands, moving awkwardly. CRUSHER sits in his corner raring to go. After the video plays, RIBA says hello:

RIBA: Hello everyone. I just want to help you!

CRUSHER: Rawwww!

RIBA: Ouch, that sounds like it hurts, Mr CRUSHER. You know, you look like a big spider?

CRUSHER: Enter my web, bear!

ANNOUNCER: Ok wrestlers. I want a clean fight. No hits below the tires. No undo spraying of hydraulic fluid.

CRUSHER is shaking, ready to go. RIBA seems serene, unaware. Her arms are down to her sides. Cue *CRUSHER motor rev* sound.

ANNOUNCER: Ok, bots. Let's fight!

Cue *wrestling bell*. CRUSHER immediately charges RIBA.

CRUSHER: I'm gonna crush you, bear!

RIBA raises her arms and CRUSHER runs into them. He's hit in the eyes. Cue *poke sound*.

CRUSHER: Arrgh! My laser rangefinders.

RIBA: Sorry, sir. It's sometimes hard to control my incredibly long arms.

ANNOUNCER: Ohh man. CRUSHER charged right into RIBA's arms. An initial rush turns into a big blunder. Now he can't use his machine gun.

CRUSHER: Argg! I still have my optical cameras. It's Spinnin' time!

CRUSHER rushes close to RIBA and does a spin. Cue *CRUSHER spin*. RIBA is spun around several times with her arms lowered. She seems disoriented.

RIBA: Where did you go? uugh I can't help you if you keep spinning.

ANNOUNCER: CRUSHER has performed his Spinnin' maneuver. It look's like RIBA is dazed.

CRUSHER: Raww. It's Crushin' time again!

ANNOUNCER: CRUSHER is going in for a second crush attack! Oh I can't watch!

RIBA is stops spinning and raises her arms. CRUSHER runs into her arms again, knocking out his optical cameras.

CRUSHER: Arrgh, my optical cameras! I can't see, I can't see.

CRUSHER staggers back, blind.

ANNOUNCER: Oh my goodness. Can you believe it? CRUSHER rushed RIBA again and, again, she poked him, this time in the optical cameras. He's blind! What a blunder!

RIBA: Ouch, sir. It sounds like you need my help. I'll put you to bed …

RIBA comes up next to CRUSHER and lowers her arms to lift him.

RIBA: Lifting begin.

CRUSHER: No, bear. I don't need your puny help.

RIBA: Of course you do … oh, oh, you're heavy. I hope you don't weigh more than 30 kilos.

CRUSHER: Arrghh!

CRUSHER suddenly slips out of RIBA's arms and falls on his side. He's stuck like a turtle.

RIBA: Lifting failed … Dropping succeeded. I win, fool!

Cue *wrestling bell*.

ANNOUNCER: Wow, I can't believe it. David defeats Goliath, RIBA defeats CRUSHER! What a historic moment. CRUSHER blinded himself and RIBA took the opportunity to flip him over like a turtle. CRUSHER's weight advantage was used against him. What a match, what a moment in history!

RIBA stands at the center of the ring and raises her arms in victory.

ANNOUNCE: The winner, for the HELPERS, RIBA!

Cue *RIBA theme*. Cue *Interim 1 music*.

BigDog vs Asimo

Chars: ASIMO, BIGDOG, GALAXY-STARLINE

ANNOUNCER: This next match is a mano-a-mano battle of the legs. Humanoid servos versus quadrupedal hydraulics.

ANNOUNCER: In this corner, walking on 4 legs and weighing in at 320 lbs, representing the MilBots, the reigning 4-time Middleweight champion … the Boston Dynamics BIGDOG. Cue _BIGDOG_intro. BIGDOG comes out and makes a few rounds, head butts the audience a bit. Cue *BIGDOG engine sound*.

ANNOUNCER: And the challenger, in this corner, able to negotiate household stairs and human utensils, representing the HELPERS, straight out of Japan, the Honda ASIMO. Cue _ASIMO_intro. ASIMO makes a round or two getting hi 5s from the crowd.

ANNOUNCER: Ok. Challengers. You know the rules. I want a clean fight. No hitting below the tires (although obviously neither of you have tires) and no undo spraying of hydraulic fluid, let's keep the mats safe, bots. Ok. At the ready … Fight!

Cue *wrestling bell*.

ANNOUNCER: Uh oh. Looks like BIGDOG is charging straight in with what appears to be a patented Head Butt maneuver.

ASIMO turns and is head butted by BIGDOG. ASIMO falls. Cue *wrestling bell* twice.

ANNOUNCER: Oh no. ASIMO is down. We haven't seen carnage like this since his 2006 stair spill. … One of ASIMOs technicians is entering the ring. Although vicious, that was a legal surprise maneuver by BIGDOG.

A technician appears with a partition. ASIMO is raised and the technician retreats.

ANNOUNCER: ASIMO is back up again. Ok, let the fight resume. Cue *wrestling bell*.

ASIMO turns towards BIGDOG. Cue *ASIMO dance music*. ASIMO starts dancing in a slow and awkward manner.

ANNOUNCER: Wow. ASIMO is hitting back with his slow and awkward dancing attack. BIGDOG seems confused. It's so lame, how can he do it? Could BIGDOG even dance with 4 legs?

BIGDOG moves as if it's confused. ASIMO takes the opportunity to kick BIGDOG who falls backward in an exaggerated manner (like the slow motion kick in the BIGDOG video) into the audience. Cue *Big Dog slow engine*.

ANNOUNCER: Wow what a kick! ASIMO nails a confused BIGDOG and BIGDOG just flew into the crowd. What a turn of events. First ASIMO is down and now BIGDOG. Who would have thought this would happen to the reigning 4-time champion?!

ASIMO celebrates as BIGDOG slowly gets to its feet. Cue *BIGDOG engine* again.

ANNOUNCER: Uh oh. I haven't seen BIGDOG this mad since the aluminum bat incident. ASIMO better watch out. … Yes, it looks like BIGDOG is winding up … yes, for a Clothesline Hump move! Cue *BIGDOG hump*.

BIGDOG shakes twice then runs sideways at ASIMO. ASIMO is hit once and staggers backwards.

ANNOUNCER: ASIMO hates physical contact. Only his technicians are allowed to touch ASIMO. It looks like BIGDOG wants to knock ASIMO over for a second time in the match.

BIGDOG hits ASIMO a second time. ASIMO staggers backwards but does not fall.

ANNOUNCER: ASIMO just won't go down. All of that Push Recovery simulation training is paying off right now.

Cue *ASIMO push recovery*. BIGDOG steps back again and this time exaggerates getting ready to run in a cartoon-like manner.

ANNOUNCER: I've seen it a thousands times. BIGDOG is winding up for the coupe-de-gras, a third Clothes-line Hump. … Here it comes, the pitch!

ASIMO quickly ducks down and BIGDOG runs right over him … straight into the GALAXY-STARLINE milking machine. Cue *Milker milking*.

ANNOUNCER: Wow. I can't believe it. ASIMO feinted at the last second and BIGDOG went straight over him and into the GALAXY-STARLINE milking robot! What a brilliant play by ASIMO.

ASIMO celebrates in place with some fist pumping. BIGDOG thrashes a bit as the GALAXY-STARLINE milker sucks out it's hydraulic fluid. BIGDOG falls at the end of the video. Cue *wrestling bell*.

ANNOUNCER: In all my minutes of Robot Rumble announcing, I never would have thought the 4-time champion would have all of it's hydraulic fluid milked away in front of a live audience. What a turn of events. … The winner and new Middleweight champion … the Honda ASIMO!

Cue *ASIMO theme*.

The ASIMO technician returns with the partition to help up BIGDOG.

ANNOUNCER: ASIMO is a good sport. His team has come out to help up BIGDOG. Everyone give them a hand.

BIGDOG leaves the ring into the dressing room and the technician retreats. Cue *Interim 2 music*.

Reaper vs Google Car

Chars: SENTINEL, SCIENTIST, REAPER, GOOGLECAR\ REAPER Chars: COMMANDER - PILOT - SENSOR

ANNOUNCER: In this corner, with a wingspan of 90 feet and a General Electric T34 turbofan producing 9275 lbs of thrust, representing the MilBots … the RQ-170 SENTINEL unmanned aerial surveillance drone.

The SENTINEL, comes out as the initial MilBot contender, but is hijacked by an Iranian SCIENTIST wearing a lab coat who takes it over with his cell phone. Cue modem connection sound.

ANNOUNCER: What's this? What a turn of events! Looks like the Iranians have hijacked the SENTINEL before the match has even begun. Can you believe it? And there it goes, off into the wild blue yonder …

The SENTINEL then flies away. Cue *jet engine flyby sound*. Cue *Sentinel video*.

The MQ-9 REAPER is then called in as a replacement.

ANNOUNCER: Looks like we'll have an obvious last minute change on the MilBots side.

ANNOUNCER holds hand to ear, feigning an in-ear radio.

ANNOUNCER: This just in, it looks like the MilBots are calling in a replacement …

COMMANDER: REAPER 1-0-7, proceed to new mission area at Bakery Square and await further orders.

PILOT: Pilot copies.

SENSOR: Sensor copies.

PILOT: Proceeding to Extra Fancy art show space.

The *REAPER intro video* plays and the REAPER comes out, does a couple circles around the audience, and then flies out into the space. Cue *airplane take off sound* & *REAPER engine sound*.

ANNOUNCER: In this corner, weighing in at 3000 lbs and sporting a LIDAR or laser-range finder hat, representing the HELPERS, the Google Self-driving Car.

Cue *GOOGLECAR intro*.

Cue *GOOGLECAR mode change sound* (get from video).

GOOGLECAR: Google Car autonomous mode

The car then starts moving out into the space. Cue tire squeal sound.

ANNOUNCER: Alright, our contenders are out and about in the space. Let's get ready to rumble.

Cue *bell sound* (ding ding).

COMMANDER: New target designated. Target is a Silver Toyota Prius. Acknowledge.

PILOT: Pilot copies.

SENSOR: Sensor copies.

Cue *sensor pursuit videos*.

SENSOR: Target spotted. Heading 9-3 at 40 mph.

COMMANDER: Target confirmed. Silver Prius has priority.

PILOT: SENSOR, you can lock on target 1 with tail 1-0-7.

SENSOR: Roger.

COMMANDER: PILOT, request weapons loadout.

PILOT: We have 1 missile and 1 laser guided bomb on a REAPER in the target vicinity.

COMMANDER: Pilot, you are cleared to engage Silver Prius at your discretion.

PILOT: Cleared to engage Silver Prius … Go ahead and fire the laser.

SENSOR: Lasing.

PILOT: Within range … 3 … 2 … 1 … rifle.

ANNOUNCER: The REAPER just launched a GBU-12 Paveway II laser guided bomb. Oh the robo-manity!

Cue *REAPER bomb video*. The GOOGLECAR however, is too fast and swerves.

ANNOUNCER: Wow. Did you see that. The google car swerved at the last minute. That robot doesn't drive like grandma!

PILOT: Target missed. Prepare missile.

SENSOR: Copy.

ANNOUNCER: The car may have avoided a bomb, but a heat-seeking Hellfire II missile is a different story! Is this even fair? A car against a missile-armed drone? Hey, I'm just the announcer, I don't make the rules.

COMMANDER: Go ahead and fire the laser.

PILOT: Master arm on missile is hot.

SENSOR: Lasing.

PILOT: Within range … 3 … 2 … 1 … rifle.

Cue *REAPER missle* video. The car is hit.

ANNOUNCER: Wow, what a display of might. The car was hit by the Hellfire … is the match over?

GOOGLECAR: Damage sustained. Pedestrian avoidance safety systems deactivated.

ANNOUNCER: What's this? The car is still going? Was that not a direct hit?

GOOGLECAR: Indexing GPS position. Searching Google Maps for pilot location.

ANNOUNCER: What's going on? Is the GOOGLECAR looking for the drone pilot? Does Google know everything?

GOOGLECAR: Drone Pilot located. Plotting path with Google Streetview. … Optimum path found.

The GOOGLECAR starts driving back towards the ring. Cue *tire squeal sound*. It plows into the crowd from behind.

ANNOUNCER: Look out everyone! The Google Self-driving car is out for blood and there's no safety systems in place!

PILOT: Wait. This is supposed to be a video game! You can't actually get us!

SENSOR: Yeah. Ignore the people behind the curtain. This isn't real!

Cue *tire squeal sound*. The car rams right into the back stage area. Cue *car crash sound*.

PILOT & SENSOR: Arrghh!

Cue *wrestling bell*.

ANNOUNCER: Wow-weee! What a finale! The Google Self-driving car ran over the REAPER drone operators. Look behind you ladies and gentlemen. Without an operator, the drone is harmless.

REAPER slowly circles in a pilot-less death spiral until ultimately crashing.

ANNOUNCER: And the undisputed winner … the Google Self-driving Car!

Cue *GOOGLECAR theme*.

ANNOUNCER: This is another brilliant win by the helpers! David versus Goliath all over again! What a match! What an ending! What a Rumble!

Cue *Outro music*.

Robot Rumble Rematch (Cyborg Cabaret)

MilBots: autonomous military robots (largely US)
HELPERS: helper and nursing robots (largely Japanese)

Chars: ANNOUNCER, ASIMO, BIGDOG, CRUSHER, GOOGLECAR

ANNOUNCER, ASIMO, & BIGDOG start center stage right behind the wing curtains. CRUSHER starts up stage right behind the musicians. The GOOGLECAR starts up stage left behind the farthest wing curtain.

After her intro, Heather leaves to stage right.

Cue *The Final Countdown* and the Robot Rumble logo.

As the first bars play through, ANNOUNCER enters from stage right. Wait until 2 synth bars in.

ANNOUNCER: Welcome, ladies and gentlemen! For thousands of years, athletes have tested their strength and mettle, pitting themselves against each other in the Olympian sport of kings: unarmed wrestling.

ANNOUNCER: Into this hallowed tradition step new athletes, driven by gasoline, electricity, and an undying desire to reach the pinnacle of wrestling perfection.

ANNOUNCER: This is … ROBOT RUMBLE!

Cue Robot Rumble recap video after a short pause where music dies down. ANNOUNCER narrates video.

ANNOUNCER: Two opposing forces meet, the MilBots representing autonomous fighting vehicles and drones versus the HELPERS, robots and friends designed to serve humans and take care of old people.

Two weeks ago, the 4 time Middleweight champion lost his belt to the underdog challenger in the battle of the legs, humanoid versus quadruped, at Bakery Square in Pittsburgh, PA. Through brilliant maneuvering, the Honda ASIMO defeated his four legged challenger, the Boston Dynamics BIGDOG, when the MilBot's hydraulic fluid was milked away by the Insentec GALAXY-STARLINE milking robot.

ANNOUNCER: After this humiliating defeat, the former champion has called for a rematch, intent on settling the score with the upstart ASIMO … right here, right now, at the Cyborg Cabaret.

Fade out *The Final Countdown* and fade in *Alan Parsons Project* (aka Chicago Bulls intro).

ANNOUNCER: And so, without further ado, I welcome you, ladies and gentlemen, to this boto-a-boto battle of the legs. Humanoid servos versus quadrupedal hydraulics. The Robot Rumble Middleweight Championship rematch, the Honda ASIMO versus the Boston Dynamics BIGDOG.

ANNOUNCER: In this corner, weighing in at 54kg, able to negotiate household stairs and human utensils, representing the HELPERS, the defending Middleweight Champion, the Honda ASIMO.

Pause *Alan Parsons Project*. Cue *ASIMO intro*.

ASIMO walks to center downstage and does his characteristic wave. He grabs hi 5s from the VIP tables on the way while showing off a bit. He ends up center stage left.

Unpause *Alan Parsons Project*.

ANNOUNCER: And in this corner, walking on 4 legs and weighing in at 320 lbs, representing the MilBots, the former 4 time Midleweight Champion … the Boston Dynamics BIGDOG.

Pause *Alan Parsons Project*. Cue *BIGDOG intro*.

BIGDOG comes out and butts one of the VIP tables and pees on the other. He ends up center stage right.

ANNOUNCER: Wrestlers, you know the rules. I want a clean fight. No hitting below the tires (although obviously neither of you have tires) and no undo spraying of hydraulic fluid, let's keep the mats safe, bots. Ok. At the ready …. Fight!

Cue *Robot Battle background* music.

BIGDOG immediate tries rushing ASIMO with a head butt. ASIMO moves forward in a fighting stance.

ANNOUNCER: Uh oh. BIGDOG is charging in with a Head Butt attack!

At center stage, ASIMO side steps BIGDOG at the last second towards the audience and slaps BIGDOG's "head" aka one of the actor's asses. Both bots end up in opposite places, BIGDOG at center stage left and ASIMO at center stage right.

ANNOUNCER: Wow! ASIMO won't be fooled by that rush twice. BIGDOG tried the same thing during their last match and ASIMO only humiliates him this time around.

BIGDOG stamps his feet in frustration.

ANNOUNCER: BIGDOG sure is mad.

ASIMO beckons BIGDOG kungfu style aka "oh yeah, bring it" and wags his ass at BIGDOG, taunting him.

ANNOUNCER: Looks like ASIMO is ready for more. He's taunting BIGDOG. BIGDOG then attacks again, trying to clothesline ASIMO.

ANNOUNCER: BIGDOG's going for a clothesline maneuver!

ASIMO moves forward ready for the attack. They meet at center stage and ASIMO ducks under BIGDOG. BIGDOG goes flying over and stumbles to a halt. Both bots again end up in opposite places, BIGDOG at center stage right and ASIMO at center stage left.

ANNOUNCER: Wow, what a brilliant move by ASIMO again! He feints to avoid the clothesline and BIGDOG goes flying. Yet another humiliation, referencing BIGDOG's defeat at the hands of ASIMO 2 weeks ago when a similar maneuver sent BIGDOG into the robotic arm of the Insentec milking machine.

ASIMO taunts BIGDOG again. BIGDOG is mad, stamps feet.

ANNOUNCER: Again, ASIMO is taunting BIGDOG and boy is the bot mad.

BIGDOG suddenly stops and raises one leg.

ANNOUNCER: “Beepbeepboopbeep.” Wait. This just in!

Fade out Robot Battle background music.

ANNOUNCER: BIGDOG is calling in reinforcements from the MilBot team. Yes, it sounds like the CMU CRUSHER autonomous ground vehicle is on its way!

Cue *CRUSHER intro*.

CRUSHER bursts from the up stage right corner behind the musicians and runs towards center stage. He roars a bit and does some spins, showing off. He runs around ASIMO, who looks a bit afraid, and ends up next to BIGDOG at center stage right.

Fade in *CRUSHER theme*.

ANNOUNCER: Wait this isn’t a team match. The MilBots are flagrantly breaking the rules here. Two on one is not a fair fight, where’s the decency?

ASIMO puts up his fists to bravely meet his opponents and starts towards them. CRUSHER runs from stage right to behind ASIMO at stage left. With ASIMO at center stage, CRUSHER and BIGDOG bounce him back and forth 3 times. This should be slow and dramatic.

ANNOUNCER: Oh the carnage! What a hit … another … and another … oh no, ASIMO is going down, going down.

After the third hit, ASIMO falls to his knees. BIGDOG and CRUSHER stand over him threateningly, but not too close as to block audience line of sight.

ANNOUNCER: Is this the end, is ASIMO losing his hard fought Middleweight Championship belt?

ASIMO raises his hand to the ceiling dramatically, as if to call/implore for help. Fade out *CRUSHER theme*.

ANNOUNCER: “Beepbeepboopbeep.” What’s this? ASIMO is calling for assistance from the HELPER robots. Yes … Yes. This just in. The Google Self-Driving Car is in the building.

Cue *GOOGLECAR intro*.

ANNOUNCER: Where is it? … Wait a minute … oh no … the Car's safety systems were deactivated 2 weeks ago during it's match with the MQ9 Reaper drone!

Cue *GOOGLECAR theme*.

The GOOGLECAR comes roaring out from the up stage left corner.

Cue *tire squeal*.

The Car heads straight towards the characters at center stage.

ANNOUNCER: Watch out everyone! It's out of control! Run for your robot lives!

The characters try to flee (slowly of course) to the down stage right corner towards the exit. The Car hits them in front of the stage right VIP tables and the characters fall to the left and right of the car's path. The Car careens on through and crashes into the wall in front of the exit door, though not blocking the exit.

Cue *crash sound*. Fade out *GOOGLECAR theme*.

Cyborg Cabaret Program

First Act

1. Robot Arm Dancers - Golan Levin

A trio of robot arms dance to resounding electro beats.

2. Transmutation Of Man - North Star

This is a silent performance, portraying the evolution and hopeful transmutation of man. Inspired by the Book of Enoch, Egyptian Book of the Dead, and the Book of Changes.

3. Honey, I Slept With A Robot - Julia Cahill

Sleeping with your lover's best friend can almost guarantee the end of the relationship, but what happens when his best friend isn't human?

4. The Cyborg's Lament - JD Whitewolf

Are we any less human just because we are cyborgs? This operatic lamentation explores one cyborg's life as he / it tries to answer the question.

Intermission

Second Act

5. Simplest Sub-Elements - Heather Knight

What makes machines come alive? Live research-grade robot choreography with non-anthropomorphic robots.

6. Disintegration (After Myself) - Riley Harmon

Video and stage effects that examine the delicate relationship between people and their technological prosthetics.

7. Root Rumble Rematch - Dan Wilcox

What if today's robotic technology could be put to the test in a one-on-one wrestling tournament? How would a Honda ASIMO stack up against the Boston Dynamics Big Dog? Could a Google self-driving car defeat the high-flying power of a Reaper drone? Uh oh, RIBA the nurse robot was talking smack about the CMU CRUSHER! It's on!

8. Cyborlesque - Julia Cahill

Cyborlesque is a tantalizing cyborg burlesque piece that is sure to warm your flesh and oil your joints.

10 References

[1] Los Carpinteros, “From an Artist’s Perspective: 13 Questions - 51 Interviews,” Bielefeld DE: Kerber Verlag, 2009.

[2] R. L. Loveless, “Introduction,” in *The Computer Revolution and the Arts*, R. L. Loveless, Ed. Tampa: University of South Florida, 1989.

[3] J. Kaganskiy, “Q&A With Zach Lieberman, Founder of openFrameworks (Pt. II).” The Creators Project, 05-Aug-2010 [Online]. Available: http://thecreatorsproject.vice.com/blog/qa-with-zach-lieberman-founder-

of-openframeworks-pt-ii

[4] K. Kwastek, “The Invention of Interactive Art,” in *Artists as Inventors / Inventors as Artists*, Hatje Cantz Verlag, 2008.

[5] G. Levin, “Messa di Voce (Performance).” 2003 [Online]. Available: http://www.flong.com/projects/messa

[6] R. Goldberg, *Performance Art: From Futurism to the Present*, Third. Thames & Hudson, 2001.

[7] A. Breton, “Surrealist Manifesto.” 1924.

[8] S. Reynolds, “Rip It Up and Start Again: Postpunk 1978-1984,” Penguin, 2005.

[9] K. Pinkus, “Futurism: Proto-punk?” [Online]. Available: http://www.unknown.nu/futurism/protopunk.html

[10] M. Kirby, *Futurist Performance*. PAJ Publications, 1971.

[11] L. Russolo, “L’Arte dei rumori (The Art of Noises).” 1917.

[12] B. Lewis, “Some Thoughts on Devo: The First Postmodern Band.” 2006 [Online]. Available: http://devo.devaluate.com/Devolution.pdf

[13] R. Goldberg, *Laurie Anderson*. Harry N. Adams Inc, 2000.

[14] A. Medosch, “The Future of Memory – the Contemporary in a cul-de-sac.” The Next Layer: Art Technology and Social Change, 04-Feb-2015 [Online]. Available: http://www.thenextlayer.org/node/1312

[15] F. Bebey, *African Music: A People’s Art*. Westport, CT: Lawrence Hill, 1975.

[16] G. Youngblood, “The New Renaissance: Art, Science, and the Universal Machine,” in *The Computer Revolution and the Arts*, R. L. Loveless, Ed. Tampa: University of South Florida, 1989.

[17] D. Wilcox, “robotcowboy: A One Man Band Musical Cyborg,” Master’s thesis, Chalmers University of Technology, 2007.

[18] J. Benthall, “Science and Technology in Art Today,” Praeger, 1972.

[19] N. de Monchaux, *Spacesuit: Fashioning Apollo*. Cambridge, MA: MIT Press, 2011.

[20] D. M. Palyka, “Computer Graphics and Artistic Needs,” in *The Computer Revolution and the Arts*, R. L. Loveless, Ed. Tampa: University of South Florida, 1989.

[21] M. Hawkins, “FaceFlip.” Max Hawkins portfolio [Online]. Available: http://maxhawkins.me/portfolio/

1329

[39] “Basement Miracle: Carnegie Mellon 2013 MFA Thesis Exhibition.” Miller Gallery at Carnegie Mellon University [Online]. Available: http://millergallery.cfa.cmu.edu/exhibitions/mfa2013

[40] “CSA Performance Series.” New Hazlett Theater, 2013 [Online]. Available: http://newhazletttheater.org/csa-performance-series

[41] D. Wilcox, “robotcowboy.” [Online]. Available: http://robotcowboy.com

[42] K. Cascone, “The Aesthetics of Failure: ’Post-Digital’ Tendencies in Contemporary Computer Music,” *Computer Music Journal*, vol. 24, no. 4, Winter 2000.

[43] J. Pontin, “Why We Can’t Solve Big Problems,” *MIT Technology Review*, vol. 115, no. 6, 2012.

[44] N. T. Redd, “Venus’ Atmosphere: Composition, Climate and Weather.” Space.com, 16-Nov-2012 [Online]. Available: http://www.space.com/18527-venus-atmosphere.html

[45] F. Forget, F. Costard, and P. Lognonne, *Planet Mars: Story of Another World*. Berlin: Springer, 2006, pp. 8, 106–108.

[46] Dr. Robert Zubrin and Richard Wagner, *The Case for Mars*, Revised Edition. New York: Free Press, 2011, pp. 44, 337–348.

[47] “NASA’s Journey to Mars.” NASA [Online]. Available: http://www.nasa.gov/content/nasas-journey-to-mars

[48] “Roadmap.” Mars One [Online]. Available: http://www.mars-one.com/mission/roadmap

[49] A. A. Siddiqi, “Challenge To Apollo: The Soviet Union and The Space Race, 1945-1974,” Washington D.C.: NASA, 2000, p. 5.

[50] J. Baudrillard, “Simulacra and Simulation,” University of Michigan Press, 1994.

[51] I. Amato, “What Would Christo Do?” Fortune Magazine, 05-Sep-2005 [Online]. Available: http://archive.fortune.com/magazines/fortune/fortune_archive/2005/09/05/8271407/index.htm

[52] A. Woods, “Art to the Stars: an Historical Perspective on Space Art.” Ars Astronautica Texts and Articles, 26-May-2013 [Online]. Available: http://arsastronautica.com/article.php?news_id=24

[53] C. Dillow, “Did A Lunar Art Caper Put The First Museum On The Moon In 1969?” Popular Science, 08-Jun-2010 [Online]. Available: http://www.popsci.com/technology/article/2010-06/did-lunar-art-caper-

put-first-museum-moon-1969

[54] C. S. Powell and L. G. Shapiro, “The Sculpture on the Moon.” Slate, 16-Dec-2013 [Online]. Available: http://www.slate.com/articles/health_and_science/science/2013/12/sculpture_on_the_moon_paul_van_hoeydonck_s_fallen_astronaut.html

[55] “Lowry Burgess.” University of California, Riverside; Bio in Free Enterprise: The Art of Citizen Space Exploration exhibition, 2013 [Online]. Available: http://sites.artsblock.ucr.edu/free-enterprise/

lowry-burgess

[56] A. Woods, “The Cosmic Dancer: Sculpture and the Absence of Gravity.” 2005 [Online]. Available: http://www.arthurwoods.ch/texts/the_cosmic_dancer_absence-of-gravity.pdf

[57] Y. Clearwater, “Frank Pietronigro: Zero-Gravity Space Artist.” NASA ArtSpace, 02-Apr-2013 [Online]. Available: http://www.nasa.gov/connect/artspace/creative_works/feature-frank-pietronigro.html

[58] “Kitsou Dubois: choreographer and dance researcher.” kitsoudubois.com [Online]. Available: http://www.kitsoudubois.com

[59] T. Sachs, “SPACE PROGRAM: MARS.” tomsachs.org, 2012 [Online]. Available: http://www.tomsachs.org/exhibition/space-program-mars

[60] P. Hennessey, “My Moon Landing.” Art exhibition statement, 2005 [Online]. Available: http://www.peterhennessey.net/?show=04My_Moon_Landing

[61] J. F. Szwed, *Space is the Place: The Lives and Times of Sun Ra*. New York: De Capo Press, 1997, p. 138.

[62] “Jupiter Electron Cyclotron Emissions.” The Radio and Plasma Wave Group, University of Iowa, 2004 [Online]. Available: http://www-pw.physics.uiowa.edu/space-audio/sounds/JupiterFce/jcyclo-png.html

[63] “The Integrated Space Plan.” Space Safety Magazine, 08-Oct-2012 [Online]. Available: http://www.spacesafetymagazine.com/spaceflight/integrated-space-plan

[64] “First woman in space dreams of flying to Mars.” Reuters, 06-Mar-2007 [Online]. Available: http://www.reuters.com/article/2007/03/06/us-russia-cosmonaut-idUSL0647601420070306

[65] S. Ra, “Sun Ra Interview.” Video & Audio CD; YLE - The Finnish Broadcasting Company, 2009.

[66] D. Pettis, “Me and My Spacesuit.” Astrobiology Magazine, 16-Jul-2012 [Online]. Available: http://www.astrobio.net/expedition/me-and-my-spacesuit

[67] S. Annear, “BioSuit: The Future of Space Gear Is Being Built Out of MIT.” Boston Daily, 10-Dec-2013 [Online]. Available: http://www.bostonmagazine.com/news/blog/2013/12/10/mit-biosuit-system-dava-newman

[68] P. Webb, “The Space Activity Suit: An Elastic Leotard for Extravehicular Activity,” *Aerospace Medecine*, Apr. 1968.

[69] E. M. Jones, “Commander’s Stripes.” Apollo Lunar Surface Journal, 20-Feb-2006 [Online]. Available: http://history.nasa.gov/alsj/alsj-CDRStripes.html

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