

**ON BEYOND ETHOLOGY:
THE ANIMAL, THE ROBOT, AND THE BEHAVIORAL OBJECT**

by

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**MS Ocean Engineering, Massachusetts Institute of Technology, 2002
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Thesis

Submitted in Partial Fulfillment of the Requirements of the Degree of

**MASTER OF FINE ARTS
in**

ART

**at Carnegie Mellon University
Pittsburgh, Pennsylvania**

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Abstract

Objects that are animate occupy a special place in the human conception of the world. We ourselves are objects that are animate. So are the non-human animals which have been food, predators, cohabitants, and later companions to us during our evolutionary history. The difference between what is animate and what is not and the question of what happens when an animate object begins or ceases to operate - in essence what gives us and the other animals life - have captivated human minds for perhaps that whole time. The same goes for the apparent differences between us and those other animals.

These dark spaces in human understanding have always been filled by stories. These take the form of myths, fables, folklore, recipes for magic, and comic strips, to name a few, which act to create a gap between animal fiction and animal truth. That gap and what has splayed it, in the past and now, play a critical role in how we view ourselves and how we relate to nature in general.

Stories were also the birthplace of animate objects of human artifice - automatons, golems, homunculi and their brethren. It seems there was a will to replicate the forces that brought us about long before we had the means to take more than a couple of steps. However, the Industrial Revolution led to a world where non-biological animate objects abound, including the behavioral objects we call robots. The tools of robot-making are my tools. Therefore, in this thesis, I also discuss the history and implications of the “robot” concept and try to refine the category, one that has always frustrated definition, in a way that is germane to my work but also, I believe, accurate in encapsulating how people really conceive of robots.

My work during the program has been frequently engaged with facets of the animal, robot, and robot/animal dialogues, at some times intentionally, at others not. If a progression can be drawn onto the scattered points of my projects, it would be away from a mindset mostly engrossed in the fictions with which we surround our relationship with animals towards an effort to use contemporary techniques for animating matter purposely to simultaneously engage with animals directly, explore notions of the concept of the robot, investigate the interplay of natural materials and artificial ones, reveal the un-animal-ness in most human perceptions of animals and, finally, uncover the animal-ness of our relationship with our own objects.

Acknowledgements

I would like to abundantly thank my thesis committee for their help while I was preparing the work for my thesis show in 2006 and 2007 and for being willing to jump right back into the fray three years later when I finally collected all my rambling writings from the previous six years, topped them off with a good chunk of new perspective, and tied them into what I hope is a cohesive and comprehensible written thesis. That committee was Golan Levin, Melissa Ragona, Illah Nourbakhsh, and Jane Werner and I am very grateful to them.

A boon of the CMU MFA program is the rotating advising structure during the first two years that means so many different people with so many different outlooks peer into your doings and help guide them. I would like to thank all of my advisors from this period for all of their energy and insight. They were Fabian Winkler, Bob Bingham, Pamela Jennings, Carol Kumata, Jim Duesing, and Pat Bellan-Gillen.

The advising program is merely a formal aspect of a community that provides great accessibility to the faculty and staff and many who were not my advisors were extremely helpful to me in the years I was at CMU. Thanks to all of you! I would like to especially thank Lowry Burgess, Susanne Slavick, Christopher Sperandio, Suzie Silver, Mark Cato, John Carson, Bob Kollar, Andrew Johnson, and Fran Flaherty.

I would also like to thank my five illustrious MFA 2007 classmates, all the other art grads with whom I had the honor to walk the halls of CFA and Doherty, and my friends who were playing the role of undergraduates at the time (but who were already then straining that cage) for the camaraderie, critique, and countless capers.

A great allotment of thanks goes to my mother, Trina Ingram, my father, Lionel Ingram, and my sisters, Katharine Ingram and Sarah Morgan, for their support. Thank you very much, Katharine, for proofreading the final draft of this thesis. Any remaining typos are certainly my fault.

Finally, thanks go to Amisha Gadani for being a buddy.

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1: On The Origins of Robots, Puppets, and Behavioral Sculpture

1.1: The Perennial Nature of the Geppetto Complex

For much of the history of the universe, its inhabitants had no awareness of their own existence. Swirling gases were not self-aware. Meteors flying through space were not sentient. Bubbling lava on newly forming planets could not think, could not contemplate, could not ponder the ultimate questions.

In the case of at least one planet in the universe, organic molecules began to coalesce on the surface shortly after planetary formation, in this case 3.8 billion years ago. These molecules led, over the course of 2 billion years, to things that could photosynthesize and then things that could metabolize oxygen. 600,000 million years ago came the first shelled organisms. 4 million years ago came early hominids. Then, 200,000 years ago, fully speciated homo sapiens.

Somewhere near the end of this sequence, for the first time some creature, possibly a hominid, became self-aware. Arguably, with self-awareness came a recognition that self-existence was finite in both temporal directions from the present. Again arguably, immediately subsequent to this knowledge came the assumption that something (often in the past and, unfortunately still, a personified “something”) had been responsible for the creature’s creation. And from that followed what I will call the Geppetto Complex.

Simply stated the Geppetto Complex is the will to wrest the power of creation from the forces that created us and use them to make life by artificial means. Throughout human history this goal has been pursued through the use of technology, magic, and

sometimes the combination of both. I would argue that the Geppetto Complex influenced, if it was not the dominant motivator of, early hominid artists' painting in caves and their making figurines like the Venus of Willendorf. I would argue that the recurrence of automata in human mythologies around the world, such as Talos, the bronze giant that defended Crete in Greek mythology or the Rabbi Loew's clay Golem, is evidence of the deep permeation of the Geppetto Complex in the human psyche. I would argue that the personification (or at least animalization) of deities across the globe is also an artifact of the Geppetto Complex, in this case the backward creation of creators. In the hermetic tradition, the efforts of alchemists to bring homunculi to life using spells and their limited notions of the power of chemistry is another example of the Geppetto Complex's influence.

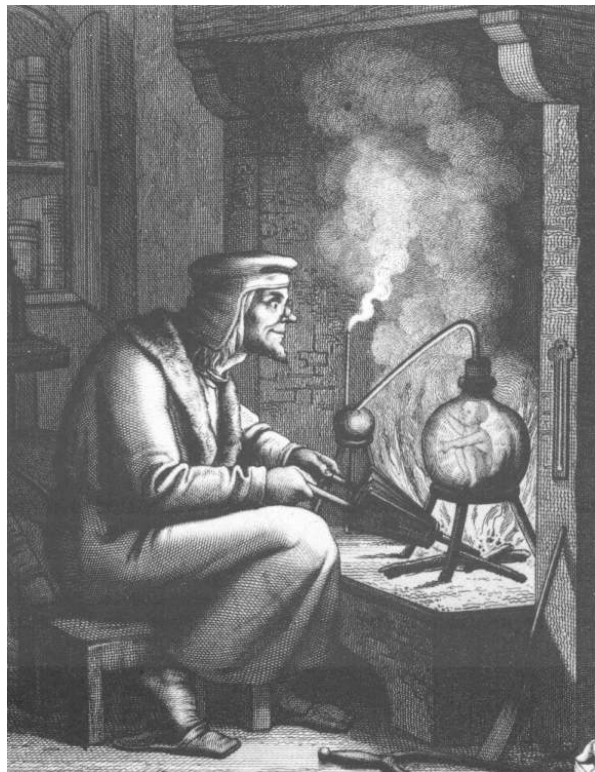


Figure 1: 19th century engraving of Goethe's character, Faust and his Homunculus.

As magic and the supernatural have waned in importance to humanity, and hence the species has moved gradually away from believing in the existence of gods and the efficacy of spells, the prevalence of technology as the tool for attainment of the goals of the Geppetto Complex has waxed, both in reality and in fiction. The last few hundred years saw the arrival of more and more complex automata such as those built by Vaucanson, the Droz brothers, and Kempelen in Europe and the Karakuri built by Tanaka Hisashige and his contemporaries in Japan.

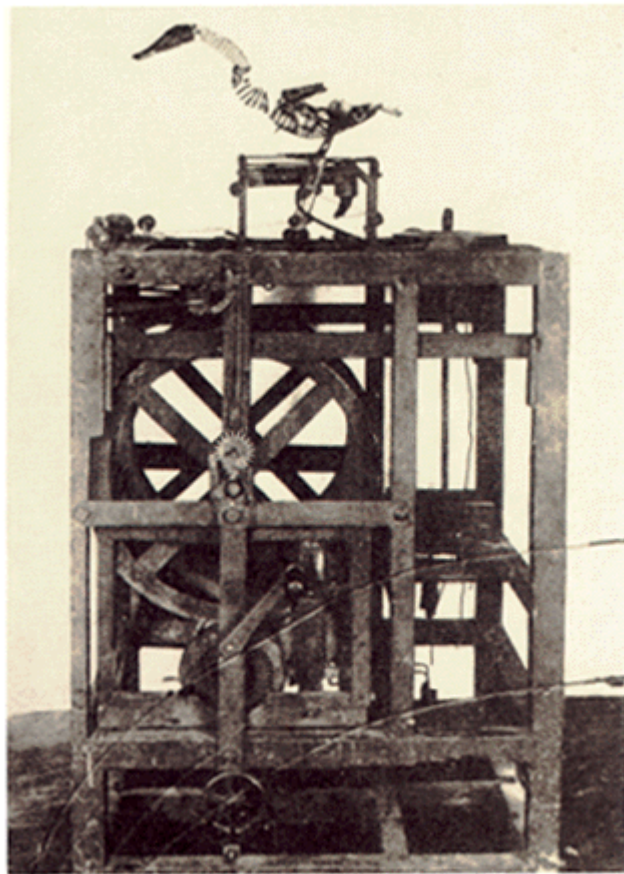


Figure 2: Photograph of what may be the remains of Vaucanson's famous Digesting Duck automaton.

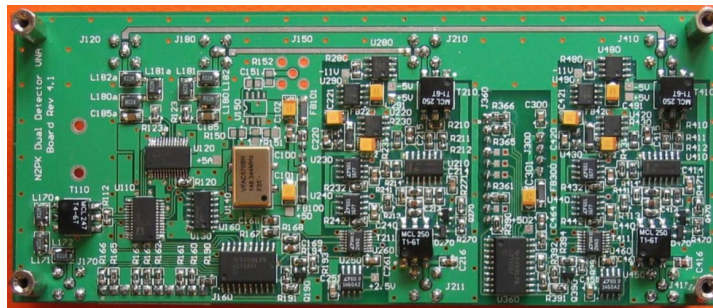
In fiction, the Pygmalion myth which had initially relied on the intervention of a god to bring the creation to life was re-formed into later stories, like Frankenstein, where technology was instead invoked. In Karel Čapek's 1921 play, Rossum's Universal Robots¹, a similarly ambitious scientist has created not one but a multitude of artificial humanoids through the use of technology; these were essentially worker-machines but still of biological origin. Many pretend that affliction by the Geppetto Complex has been solely the fate of toy-makers, entertainers, and others of their ilk but even those lauded with the creation of pragmatic ideas and technologies that have fundamentally shaped human existence have been afflicted. René Descartes supposedly built for himself a female automata that he regarded as his daughter. Thomas Edison spent the better part of the latter half of his life attempting to create talking, living dolls.



Figure 3: One of Edison's talking dolls and its voice-box.

¹ It is from this play that the word “robot” came into common use to describe intelligent automata. The word is derived from the Czech word for work.

These are merely a few examples but the past and the present are littered with instances of the ubiquity of the Geppetto Complex in human culture. It has often been a conceit of a particular era that the newest means available are sufficient for success in the creation of artificial life and in giving artificial intelligence to that life. The alchemists believed their simple conception of chemistry and biology combined with magic spells was sufficient. Mary Shelley's Doctor Frankenstein found in electricity the power to jolt life back into his stitched-together cadavers. Ambitious makers of mechanical automata postulated that with enough gears, cogs, and pulleys their inventions could transcend the boundary between simulacra and real life. Vaucanson, when he learned of the newly discovered material that exuded from South American trees, rubber, felt that surely it was all he needed to truly making a bleeding, living man-machine. The contemporary conceit that digital computers, modern actuators, and state-of-the-art sensor technology are the right kinds of stuff to succeed in the Geppetto Complex may be just as myopic. However, it is hard to dismiss the notion that we are zeroing in on the goal of intelligent artificial life and that it won't be more than 50 to 100 years before we succeed. And if we do indeed succeed? The ramifications for both us and for our "Pinocchios" are tremendous.



1.2: Lamettrian Geppettoism and Its Precursors

The suspicion that things of the world are of completely material origin is age-old. In written history we see thinkers like Democritus (who first postulated the notion that everything was made of tiny little round balls he called atoms circa 400 BC) and the members of the Charvaka group in India defending a hard-line materialist world view. It is hard not to speculate that even prehistorically, people were entertaining similar suspicions. In that along all the axes that human individuals vary from other human individuals (hair color, nose size, propensity for corpulence, proclivity to aggression, etc.), there is a notable spectrum, I would conjecture that there is a similar variance in the degree to which a human individual is predisposed to belief in the supernatural. It probably benefited humankind during much of our behavioral evolution to have individuals at both ends of that spectrum in ways that I won't go into. Hence, there have probably have always been those at the end with more proclivity to faith in natural cause and hence closer aligned to the materialist camp.²

In contemporary times we need less faith to believe in the ability of natural cause to present us with the universe we see before us. Generations of great thinkers and technologists have built a foundation of ideas, experiments, and knowledge that has

² From a more contemporary viewpoint, physics has shown that there is indeed more than merely matter in that there are energy and fields. Some argue that the term physicalism is hence more appropriate than materialism now but the stance of both ideas is essentially the same, that all universal phenomena are the result of natural processes, not supernatural ones.

slowly but surely put aside the need to invoke the supernatural to explain the world. Certainly, there are things we don't know and probably some we will never know but the pattern is clear.



Figure 5: Famous movie robot, Johnny 5, on Halloween.

However, that we don't know everything is still used simple-mindedly as an argument for the possibility of anything - no matter its unlikelihood or its linkage to the human ability to make up good stories. What we do know about some particular subjects has remained contentious in that it opposes ancient notions of human superiority, independence from the material, and need for the supernatural. Human thinking and consciousness are such subjects.

Even though ancient individuals like Democritus or a member of the Charvaka would probably have postulated that the human mind and consciousness were of material

origin more than 2000 years ago, only 400 years ago René Descartes felt compelled to restate the notion that the world and the human body were of material origin while simultaneously inventing a spiritual workaround, called dualism, that allowed for the supernatural soul to control the body through a handle in the pineal gland. It may have been that Descartes only added the workaround to appease the powerful religious leaders of the time and secretly believed otherwise but nonetheless we essentially remain at this point with the vast majority willing to put faith in and rely on the notion that the body is understandable as a natural artifact - and willingly rely on advances in medicine that have come about from the understanding that the body is a functional machine capable of interpretation as such and thus mechanically and chemically alterable - but at the same time unwilling to conceive of their minds, or at least their core consciousness, as such.

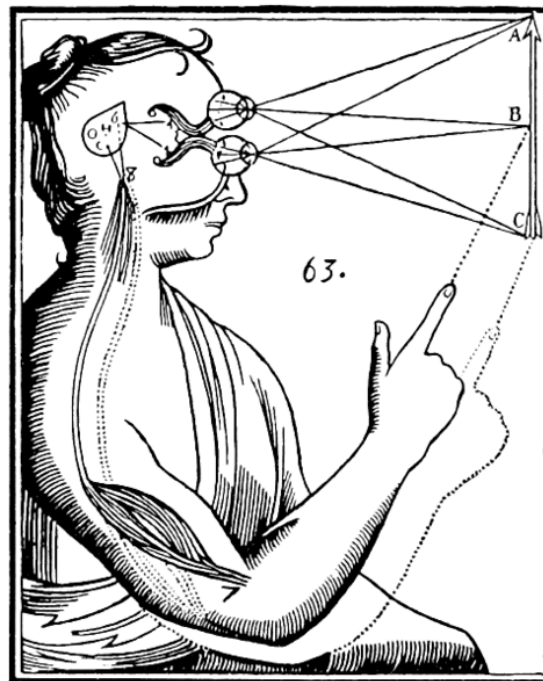


Figure 6: René Descartes' illustration of how sensing and action are connected through the pineal gland to an immaterial mind.

The voice of those who see no need to invoke the supernatural in the workings of the human mind is growing louder, however. Just a century after Descartes, in his *Man a Machine*, Julien Offray de La Mettrie posed an argument extending Cartesian materialism from the realm of the body to that of the mind and soul. He postulated that even man's mind is an evolutionary product of nature and hence a machine controlled by neurological mechanisms in the brain. In essence, La Mettrie is the true father of modern cognitive science.



Figure 7: Pinocchio as illustrated by Enrico Mazzanti for the first printing of Carlo Collodi's eponymous book.

The children's book character from Pinocchio whose name I borrowed for my term, Geppetto Complex, was a maker of toys who, in the original version of the story ends up in the possession of a piece of wood that talks and is partially animate. He carves the wood into a puppet which then proceeds to go about doing mischief and causing him

grief. The wood is already alive and has a mind and Geppetto gives it a body. In the Disney version of the story, Geppetto carves the puppet wishing for a son and then a fairy godmother brings the puppet to life. In both cases the life and mind of Pinocchio are of non-manmade origin, either mysteriously unexplained or magical. I am drawn to the playful and think that this example from a children's story, in fact, still exemplifies a serious category of how human beings have conceived of life and mind. Therefore, I use the term Classical Geppettoism to refer to all situations in which someone, fictional or real, looks to construct something they want to imbue with life and then relies on the beneficence of a "fairy godmother" to give the toy a soul and a mind. In contrast, I invented the term, Lamettrian Geppettoist, to describe anyone who builds both the bodies and the minds of their products in honor of La Mettrie's oft forgotten contribution to cognitive science. The more Lamettrian Geppettoists in action, the less is needed from fairy godmothers in the realm of vitalizing the inanimate and the more pumpkin carriages can be made for princesses. I am likely the only self-described Lamettrian Geppettoist.



Figure 8: Still from the Disney animated film, "Cinderella," showing a fairy godmother in the act of turning a pumpkin into a carriage.

Modern research is allowing us to look behind increasingly more doors in the city of the brain but we are still merely peeking through the keyholes of what might underlie consciousness. To about the same degree that cognitive scientists can currently determine the mechanisms by which the brain engenders the mental phenomena we have for millennia been aware of, the efforts of contemporary afflictees of the Geppetto Complex have recreated these mechanisms or like ones in their efforts to create artificial intelligence and clever robots.

In the last hundred years, a lot of thinking and writing has been done, by the likes of Turing, Von Neuman and Marvin Minsky, about just what succeeding at making a sentient machine would look like and thus how we would know when we had done it. Marvin Minsky made bold claims right at the beginning of the time that artificial intelligence became known as artificial intelligence that the digital computer had unlocked the door and we were only decades away from solving all the problems of sensing, thinking and acting required to make a manmade man. Minsky's boasts are a great example of the perennial conceit mentioned in the previous section that whatever materials we have at the moment, we can build a likeness of the human consciousness. Minsky even went so far to put forward a time-line of when each obstacle to the goal of making an AI would fall. We are now decades past the end of that timeline with very little checked off but many contemporary AI researchers still think that we are almost there. Perhaps we are but perhaps instead just as Vaucanson thought bellows and cogs would get him there in his youth and latex rubber in his old-age, that the digital computer, modern sensing and actuation technologies, and contemporary notions of machine thinking, and even all their imminent successors, will only get us part of what the flesh

does. Strangely, our cultural response to the proliferation of cell phones and other digital devices may be working everything in the opposite direction i.e. not helping machines become more like humans but causing humans to alter themselves to be more like machines.

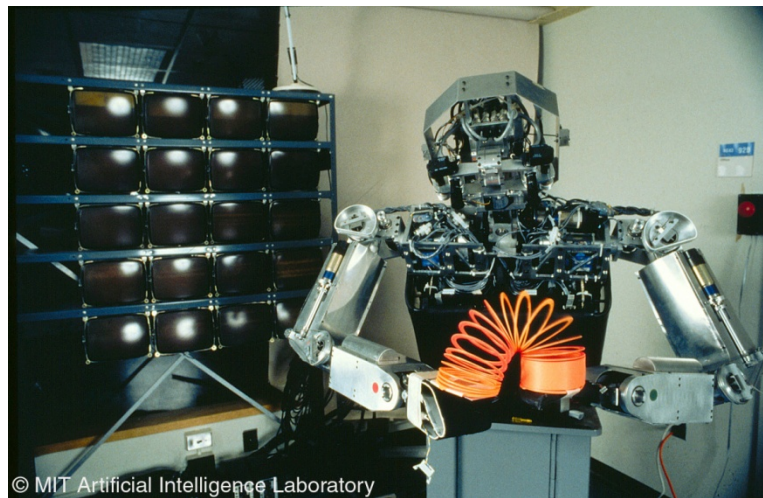


Figure 9: Cog, a 1990s vintage research robot that learned to operate in the world in the context of its body, a loose replica of the torso of human being.

Many current robotics researchers, amongst them Rodney Brooks, feel that the embodied nature of brains is tantamount not just to their being effective cores of sensing, moving machines but to their very existence; that, essentially, a brain cannot exist without a body. If they are right that a brain needs a body to be a brain then it is probably true that the nature of that body will greatly affect the nature of that brain. The ramifications of this are the most interesting when you begin to think about all the different forms robots have taken and could be made to take.

Throughout human history, would-be creators of what we now call the artificially intelligent robot have been predominantly focused on creating these things in our own image, both physically and cognitively. Because of the practical forms that robots have

taken in their evolution as industrial machines, of greater understanding of the sorts of senses and cognitive processes that animals other than ourselves have that we do not, of science fiction's exploration of the notion of the possibilities of minds, of the search for extraterrestrial life's requirement that scientists think very carefully about what defines life and, in particular, intelligent life, and of innumerable other cultural, technological, and scientific re-thinkings, we are beginning to imagine a host of other possibilities. Yet, contemporary robotics research is still quite focused on the anthropomorphic. However, zoomorphic robots are becoming more prevalent with bio-mimesis' increased frequency leading to robots that take fish-like, dog-like, insect-like, and whatnot-like forms. But what about forms that do not have their basis in what is found in the realm of natural life? Do such forms exist? Can even those concerned with the creation of a mode of artificial intelligence different from the mass human notion of how a sentient machine will think, behave and be, discover attributes that do not have their roots in the formal and behavioral solutions nature has already explored?

1.3: The Hallmarks of a Robot

Per the previous section, the tools and materials of the contemporary Lammettrian Geppettoist are those of robotics. We simply are not at a point where the manipulation of biological material is a feasible method for forming our modern-day Pinocchios. And, nonetheless, even when we reach that point, those biological Pinocchios will be as much robots as the robot is a Golem i.e. all of these categories are really the same beast in the psyche of mankind. An android is a robot is a Golem is a Talos.

So what indeed defines this anthropogenic creature, that for simplicity we will refer to by the sobriquet, “robot?” Even preeminent roboticists differ on the necessary qualifications - even vehemently arguing with each other on this point. A common definition is that a robot is a human creation that has the ability to sense aspects of the world, deliberate on those sensations, and then act upon the world accordingly. This is the core triad of robotics: Sense, Process, Act. And for those given to greater openness: Sense, *Think*, Act.³

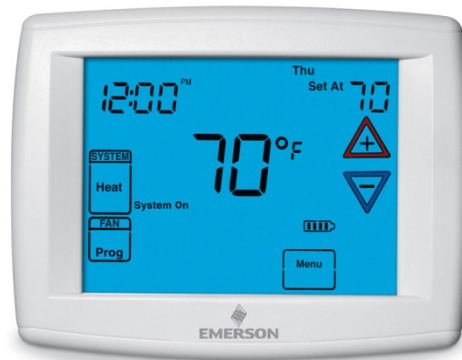


Figure 10: Is a thermostat a robot?

Taken to its most trivial extreme (where those seeking some sort of categorical purity often take it) this definition will include devices like the thermostat, which senses

³ An additional requirement, already stated in passing, is usually taken as implicit: that the robot is artificial, in the sense of being anthropogenic without relying on the natural processes that can also deliver things that have the ability to sense, think, and act. I.e. humans and other animals are not robots. Moreover it is often presumed that humans are the only animals currently trying to make or interested in making robots hence the possibility that say, foxes, could create robots will not be explored in this document.

ambient temperature, compares it to a setting and turns on or off the furnace accordingly. Categorical purists aside, most are unwilling to view the thermostat as a robot although it can be difficult to justify this chauvinism. There is a sense that in the middle step some requisite complexity is missing, that to earn the title of robot a device must be more than a sensitive switch. I am amongst those who would exclude the thermostat but I am not going to attempt to find where the line in the sand should be drawn on the grounds of complexity in the “Thinking.” Instead I put forward that there is a fourth, subtler, yet all-important requirement that people tacitly invoke when they discriminate against the thermostat. The key is in the “Mind of the Beholder.”

To explain: it is in the observation by humans and the subsequent, perhaps innate, categorizations that we apply to what we observe that the real root of robot-ness lies. Humans, as do many animals, view the world with a categorizing eye, breaking it down into myriad parts and groups of parts to better resolve it and thus operate within it. Even before we get into the realm of naming and language, our brains are dividing the things we perceive into classes, with sub-classes within those, and sub-sub-classes within those. Perhaps not everyone’s classification system is exactly like everyone else’s but clearly, probably because of instinctual rootings, vast parts are. Without belaboring the point, I will put forward that one broadly useful categorical division for an animal is between the category of things that move and that of things that don’t. Rocks and earth don’t move and when they do there are usually lots of clues that they didn’t do it on their own. Squirrels, streams, the stars, lions, and fish do move. From an evolutionary psychological stand-point one can imagine why any creature that is prey, predator, or both would attend to the things around them that move with intent: the animals. The

animal class is of utmost importance to the human (and many other species of animal). Besides other indicators that we may or may not recognize instinctually (things like the presence of eyes and the limbs and other organs) the hallmark of an animal is mindful intent, *agency* if you will. The vast majority of animals clearly exhibit agency from the human perspective however it is only an observation-based epistemological assumption (possibly rooted in evolved instinct) that animals and other humans actually *have* mindful intent, agency, and hence are like ourselves.

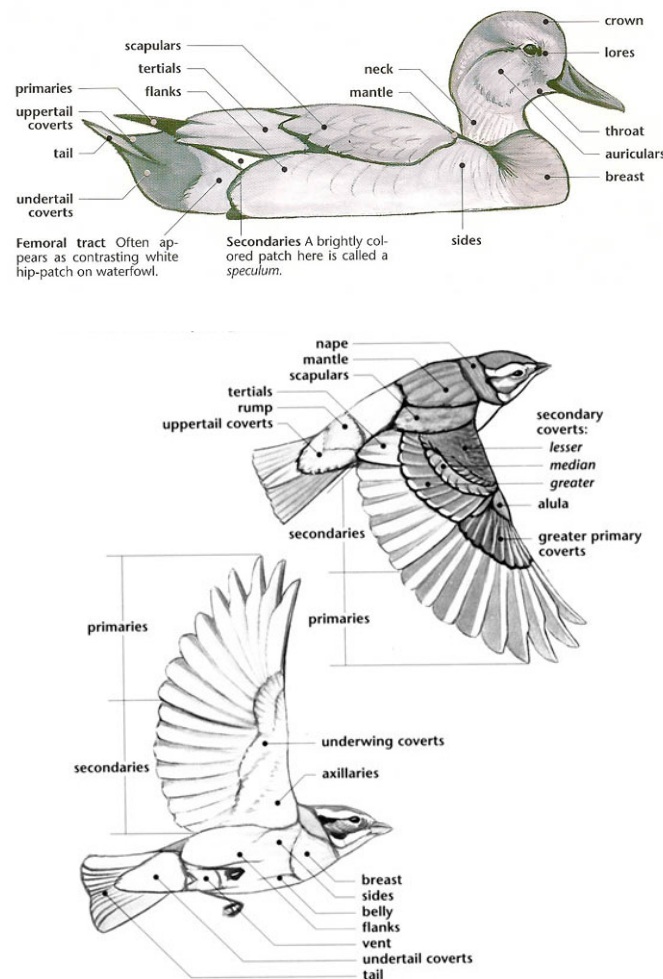


Figure 11: Humans break down and categorize. English names for various bird body structures.

You likely noticed that there are two different species, engaged in two distinct forms of locomotion.

History, likely also pre-history, is rife with the misrecognition of agency in things around us. Without the necessary overarching knowledge and understanding, streams, the wind, volcanoes, and planets seemed, to many humans, to have agency and were often treated as if they did.

Anthropogenic creations have the power to elicit a similar misrecognition. People see anthropomorphic, and zoomorphic, tendencies all around them in the machines that are ubiquitous in their lives. And in robots the most so.

Whether a creation of human ingenuity will ever achieve true agency, or what exactly defines true agency, are questions I will not tackle here. However, I will say that the hallmark of a robot is not just that it senses, thinks, and acts but whether in doing so it elicits in the human observer the perception of agency and hence seems to us a willful entity. This is the fourth and most important requirement of a robot: that it create a semblance of mindful intent.⁴

1.4: The Robotics Sculptor's Medium

The creation of an artwork involves the integration of a number of elements. In painting for instance, composition, form, color, chiascurro, texture etc. are integral to the final work. The medium is paint which is in its essence controllable color. A given

⁴ Truly, whether this requirement is met is in the Mind of the Beholder. Indeed, a thermostat may come to seem willful, even capriciously so, to a given individual in certain circumstances but it is easy to defend that that semblance of mindful intent is far weaker than that of say a Roomba vacuum cleaner, an industrial arm robot, a self-driving automobile or a behavioral sculpture and is more often not experienced at all.

painter may pay special attention to one element over the others but the core element from which almost all other elements are derived is color. Now consider drawn animation. Such animation is the creation of a series of still images that when shown one after the other in rapid succession create the illusion of action playing out over time. Many of the same elements that come into play in painting are again fundamental to drawn animation such as composition, color, and texture. However, the addition of time to the mix means that animation gains the elements of movement, gesture, action, and unfolding narrative amongst a number of possible others.⁵ Again, a given animator might focus on one element more than another in their work. Perhaps that might even be color. However, for the majority of animators, movement and gesture are at the core and are emphasized over other elements in the animators training. Moreover, when animation was in its nascence, these were the elements that were explored the most. They were the things that still images hadn't had⁶ and hence were the most exciting new territory. Movement remains the core element of animation, drawn or otherwise created.

When confronted with a sampling of work which well-represents an art form and asked to identify the core elements, a safe bet is to look for those instances where artists

⁵ Despite imaginative interpretations of the experience of viewing paintings or envelope-pushing experiments by great painters, these elements are far more the providence of animation.

⁶ Again, it is worth noting that many painters tried to have these in their pictures, from Duchamp to perhaps the ancient artists in the caves of Lascaux, but an honest appraiser recognizes that the way a still image alludes to gesture is quite a bit different and heavily abstracted from true gesture or animated gesture.

have chosen to address very few elements in favor of just one or two. Drawn animation serves as a particularly good example, probably because the labor-intensive nature of the art form encourages the foregoing of anything but what really matters to the maker and their work. In general, when drawn animators distill, what results are very simple line drawings that focus on movement and gesture or alternatively on narrative and dialogue. Even animators who engage with vibrant colors, usually focus on experiments with the movement of such. A big, mainstream animation house can afford to liberally add color and texture to their animations and through the use of photocopiers or digital tools a solo animator can use detailed forms in their animations but almost always motion remains at the core and if it is neglected the result, as animation, suffers.

Looking at another art form which shares some core elements with animation, dance, you can again see that when dancers strip away costume, lighting, narrative, etc. what remains is gesture and movement. Of course, dance is primarily about those gestures and movements that are makeable with the human body in the real world as opposed to the gestures and movements of drawn animation which are restricted to what can be drawn, both opening many doors and closing others.

So, every art form is a composite of a number of different elements. Two different art forms can easily share a number of these elements. A given art form taken as a whole often privileges a few elements over others, usually those that are the most special to that form, perhaps even unique to it. This often follows from the reasonable desire of the practitioner of the art form to explore what that art form can do that others can't. There are certainly exceptions but when a work doesn't focus in the elements that

are special to that form it is likely to be constrained by and derivative of the experiments that were done in some other art form, probably one that arose earlier than it did.

The question then is: What is the core element of robotic sculpture? From a straight forward stand-point the medium is the integrated mechanical, electronic, and computational systems that are dubbed robotics. But perhaps in the way that gesture can be thought of as the dancer's medium as much as his body can, perhaps something a little more abstract is the true medium.

Robotic sculpture shares with static sculpture the elements of three-dimensional form and color and the potential for existence as an actual object as opposed to a representation. It shares with kinetic sculpture all of those plus gesture and movement. However, although some gestures and movements of a robotic sculpture might be deterministic or passively induced by natural processes as those of all traditional kinetic sculpture are, the core movements and gestures of robotic sculpture are in response to external environmental stimuli. They are, in essence, behaviors and behavior is the core medium of robotic sculpture. In fact, since robotics has come to refer to a very particular set of technologies that need not be the raw materials of artists interested in sculptural behavior forever, perhaps more apt than the terms robotic sculpture and robotics sculptor are behavioral sculpture and behavioral sculptor.

Behavior, though, really is a hard thing to present to an audience. Discerning behaviors, even simple ones, requires time and often careful observation and these, regrettably but truthfully, are not something generally given by an audience. Moreover, there is an opposite problem: people are likely to attribute more complexity to an animate object if they are led to view it as a behavioral agent than is there. It is a human

assumption germane to a core topic of this thesis: the complex interweaving of our anthropo- and zoo-morphic tendencies in viewing ourselves, other animals, objects and anything animate. A simple algorithm with a tad of randomness embedded may be perceived in the same way as a sophisticated, directed one in many situations. People invent very elaborate narratives around the former. Working with the medium of behavior therefore requires both engaging your audience to spend enough time in observation and contemplation that they begin to decipher the behavioral elements and, more importantly, finding ways to communicate intention and agency through channels (vision, audition, etc.) that are salient. Incidentally this is exactly what animals, including humans, are doing with all of their calls, songs, wags, waves, winces, smiles, laughs, pheromones, gestures, crouches, teeth-barings, lip-flips, sulks, chest-thumps, trumpeting, and hackle-raising. They are making their internal states external for others to interpret. Deliberately or not, they thereby allow the others to understand their past, present and future behavior.

1.5: On Beyond Ethology

Behavior as a complex active response to an environment is, or was, unique to animals. Animal life is constrained in what behaviors suit its purposes by the very process of natural selection that sowed the seeds for behavior's development. An animal's behavior is adapted towards the process of survival: collecting food, avoiding danger, procreating etc. A particular animal's behaviors are further subject to the particular genealogy of that animal's predecessors. In the same way that there are skeletal vestiges of hind feet in a blue whale, there are less obvious artifacts of

ancestors' behaviors, and the situation those behaviors were suited to, in the current behavior of a contemporary animal. Furthermore, the development of a behavior in a maturing animal may, arguably, be subject to constraints similar to those on developing morphology that D'Arcy Thompson elucidated: behaviors have to “grow” in a given animal and thus behaviors must be things that can grow and be grown from.⁷

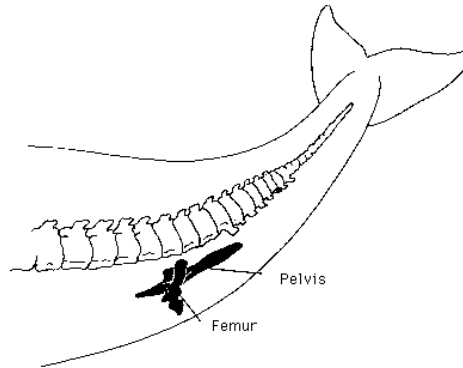


Figure 12: Cetaceans have vestigial femurs and pelvises. Humans have the vestigial low-level behavior of forming goose bumps. Might we have vestigial high-level behavior? Like a capacity to learn something un-learnable when not growing up in our ancestral circumstances?

Man is the first animal capable of making non-life that has behavior and it is only in the last half century that we have really begun to do so, initially as tools but more frequently in all sorts of aspects of human culture. The constraints on behavior of the first behaviors, animals, laid out in the previous paragraph do not apply to this behavioral non-life. A maker of a behavioral object can imbue it with behaviors that have nothing

⁷ Somewhat related: There are metamorphic insect species that use neural ganglia and associated muscle patterns to do two distinct activities, one pre-metamorphosis and the other post-.

to do with the object's "survival" and everything to do with anything else. Nonetheless, the behavioral complexity of any manmade system continues to pale in comparison to that of natural animal systems - especially species like man.



Figure 13: As of this writing, you still trump any robot in behavioral complexity (if you can't see your reflection, it's because the silvering wasn't done on this copy of the thesis).

The scientific study of animal behavior is called ethology, a field that encompasses many lines of inquiry including the study of animal communication. People have always observed animals, often for practical purposes but sometimes out of pure curiosity. The record of those observations can be found in stories, myths, writings⁸

⁸ For instance see the Bestiaries, ancient catalogs made by medieval monks of the form and behavior of animals both familiar and unfamiliar to them. These are discussed more in the next section.

and even figures of speech used to talk about other people such as “clever as a fox” and “stubborn as a mule.” The formal science of animal behavior, however, was initiated fairly recently with the work of notables like Konrad Lorenz and Niko Tinbergen.



Figure 14: Konrad Lorenz, a founder of modern ethology, showed that goslings would “imprint” to him as the parent in the absence of their true parents when they were born.

Much of what has been learnt in the past hundred years of ethological study has been surprising. Sometimes what has been surprising is how “dumb” a particular behavior is, such as the imprinting of goslings when hatched to just about anything from a person like Konrad Lorenz to an object like a bright plastic cube. On the other hand, sometimes the surprise has been that behavior capabilities previously thought to be the sole domain of people, such as tool use, are exhibited by a number of other species and that more and more the difference between human use and animal use of a particular kind of behavior is one of degree of complexity. There appears to be a continuum of behavioral complexity, albeit perhaps with a spike in the curve near humans.

The possibilities of behavioral objects are manifold and certainly not restricted to things that are at all related to the behavior of animals. But behavioral objects do open up possibilities for exploration, scientific and, perhaps, aesthetic, of animal behavior and its relation to us that were unavailable before. They can be made to be machinic/chimerical simulacra, or partial simulacra, of animal activities that have significances for people. They can be made for attempts at direct communication with an animal species using gestural forms that are recognizable to that species. They can be made as pseudo-bodies for human observers that allow a very different kind of communion than is possible with our own human bodies.

In my own work, although a typical form of telepresence is not employed, the building and coding processes I use to create my machines does result in an extension of me, and perhaps the viewer can see these machines as extensions of a human psyche into a non-human body better fit to cohabitate with animals that are not our shape and size. In deference to Doctor Seuss's book, *On Beyond Zebra*, which is an explanation of what letters come after "Z" and what creatures, stranger than zebras, such letters are needed to name, I call the making of such behavioral sculptures "On Beyond Ethology."

2: Influences and Relevant Artists

2.1: Why Look At Animals?

I am primarily interested in the animate and particularly those animate things that control themselves. In the natural world, animals, amongst them humans, essentially fully comprise this category. Human beings have always been fascinated with animals and it's not surprising: all animals are "fascinated" with other animals as they represent potential mates, prey, predators, and even allies (in the form of kin and in some cases symbionts). Human beings have brought their usual set of tricks to the subject of the animal - stories, superstitions, application-oriented thinking - including their sense of being both of the animals and apart from them, the kind of line we like to draw all over the place when it comes to nature.

The story is at the heart of much of our relationship with animals. In the fable, the animal becomes the anthropomorphic stand-in. The aspect of humanity that a particular animal in a fable represents is also usually what that species is known for, for example slyness in the case of foxes or capriciousness in the case of goats.⁹ Animals get reps, even though in many cases these are mistaken or are an example of just a portion of the animal's whole behavioral spectrum. In fact, misrepresentation of animals has been a long theme from the Bestiaries (penned by medieval monks that will relay to you such facts as the beaver's habit of castrating itself when hunted as it knows the hunter's true

⁹ It's no accident that the word capricious is in fact derived from the word for goat and moreover that group names for many species are embedded with these same linkages e.g. a shrewdness of apes or a pride of lions.

quarry are its medically-valuable testicles) to the Mickey Mouses and Billy Goat Gruffs of the current culture that lead children to grow up really confused about what animals can do, think, and be.



Figure 15: Illustration from the Aberdeen Bestiary depicting how the beaver when pursued by hunters rips off its testicles sacrificially.

The artist, Walton Ford, appreciates the distance between uses of animals in stories and fables, and even what might be called the modern mythologies associated with extinct species, and the truth of the animal. By creating masterfully faithful representations of animal form while placing his subjects in the absurdities of these fables

and contrivances, he reveals much about the difference between the two. He occasionally reverses the fable by using animals as more faithful mirrors of current humanity than fables ever were before.



Figure 16: Walton Ford "Ornithomancy No. 3a" (2001)

Fischli and Weiss made a short film, "The Right Way" that for me speaks, amongst other things, to this same discontinuity between what animals are and the "animal characters" that play such a large role in our society. They dress up in their rat and bear costumes and live out little narratives in the outdoors. Their adventures are absurdist in other ways but I found two things particularly compelling in viewing the videos when I saw them: 1) that their lifeless costumes cum skins were hung nearby in

smoked plastic columns, obfuscating them 2) that they at one point appear to have a pet goat, a real goat, the kind of goat that stands (on four legs) in marked contrast to the bipedal fake rat and bear that lead it around.



Figure 17: Two stills from Fischli and Weiss's "The Right Way." In the first, Rat and Bear help a turtle to right itself. In the second, Rat and a piglet meet.

On the subject of goats, I brought up earlier Billy Goat Gruff, a fairly modern character who confuses human goals and intents with caprine ones. You might think that the errors of non-religious anthropomorphization and our plethora of animal characters are the result of the modern lifestyle, one so divorced from interactions with nature that its practitioners cannot avoid such mistakes but then you might think of the real goat's once-supposed plague, the goatsuckers. "Goatsucker" is the common synonym for individuals of the nighthawk and nightjar families. The birds have really large gapes because they are crepuscular aerial-insectivores and, I presume, need a big funnel because their accuracy is less than diurnal species with similar feeding strategies. Farmers surmised from the gapes, and maybe some other circumstantial evidence, a different hypothesis: that these birds fed by sucking on the teats of goats. Considering that no goatsucker has ever been observed doing this by anyone in recent memory, you see that past rural people can be just in the dark about animal reality as modern city people and that an enthusiasm for folk wisdom might want some curbing.



Figure 18: Nightjar revealing the large gape that people couldn't resist speculating about.

The artist, Joseph Beuys', project "I Like America and America Likes Me" (1974) in which, amongst other things, Beuys spent a few days living with a coyote, evokes ideas, inadvertently or not, about the difference between real animals and their use as symbols, between a human's and a non-human animal's experience in being penned and watched, and about the simple relationship of two different species, both likely to be at least pre-cognitive if not cognitive. Beuys has used animals and animal parts in other work in ways that I respond to. For instance in his performance, "How to Explain pictures to a Dead Hare" (1965), he did just what the title leads you to believe and I, independent of what Beuys may have thought this project was about, feel it simultaneously exposes pitfalls of anthropomorphization and supernatural thinking. In my work before, and in my earlier work during, this program, I felt there was a resonance between Beuys' use of mythic structures and my own. However, I have come to see a lot of Beuys' work as being the outcome of a rejection of truth seeded by his own cognitive dissonance with regard to his past and his culture's infatuation with mythology (an infatuation that is strong in our culture too). I begin to wonder if his work is an obscuring force rather than a revelatory one. The line between dissembler and guide is as thin as the line between a mythic structure that acts as a veil to truth and one that acts as a bridge to new truths. I wonder if Beuys and those who follow in his footsteps by mythologizing and aestheticizing aspects of our society that might be best laid cold and bare on the stone slab of rational critique are practicing an elitist sort of escapism. When the mythic structure is used to bring an audience to a transformative imaginary space as a path to a new understanding and exposes the shortcomings of old understandings, however, it becomes a useful tool and not a nostalgic shroud.



Figure 19: Joseph Beuys with hare. Do you think animals understand naïve symbolism?

In contrast to Beuys's use of a live animal primarily as a symbol and thus an object there is the interspecies efforts of Jim Nollman, a musician and experimenter who attempted through music to achieve a communication and experiential middle-ground with such diverse accompanists as turkeys, wolves, and toothed whales. In all likelihood, Nollman sees himself as the accompanist to musical tendencies his activities unlocked in these animals. As sometimes earnestly over-enthusiastic as he was, I am more in accord with Nollman's attitude than Beuys's at this stage. I think there is a magic in an honest and directed approach to conceiving animal experience and in the case of some animals, animal minds. Both Nollman and Beuys harbor what I view as fictions in their ideas about animals but Beuys, perhaps inadvertently, protected his fictions since he primarily engaged with animals once they were dead. I think it is revealing that in most of the

documentation of “I Like America and America Likes Me” he seems to be protecting himself from the coyote.



Figure 20: Jim Nollman playing a waterphone with accompaniment by orcas. The waterphone was invented by Richard Waters.

Religious mythology has animals play myriad roles. Gods and goddesses transmute into swans and hippopotamuses, devils appear as snakes, and deities are likened to lambs. Chimerical animals, including those that are part human, abound as well. It is not surprising as, as mentioned before, human traits are often seen in animal clothing and you might just as easily borrow only a bit of the animal’s form and glue it on to something otherwise mostly human to make the same point. What’s interesting is that in the anthropological/historical record we rarely see such hybrids in lighter situations whereas in the last couple hundred years and especially in the last hundred with Beatrix Potter, Walt Disney and their like making their marks, you *mostly* see them in such. In fact, it is hard not to see the Hindu deity, Ganesh, as a cartoon character because of this.



Figure 21: A contemporary depiction of Lord Ganesh beside an image of the Wuzzle named Eleroo, a hybrid elephant/kangaroo cartoon character from the 1980s.

This brings us to cryptozoology, the study and pursuit of animals of uncertain state of existence, in a way the modern follow-on of the supernatural suspicions of olden-days given a scientific bent. In fact, many of the stars of cryptozoology, the Loch Ness monster, the Yeti, the Mokele-mbembe, originated in pre-scientific lore but had enough panache and just enough plausibility that modern scientists and pseudo-scientists don't discount them. That plausibility has been justified by the story of the Okapi and the Coelacanth, which represent the great success stories of the cryptozoological effort, and by the simple reality that we keep discovering species undocumented by science. There's a Necker-cube-like transmutation that happens once a cryptozoological animal is discovered that reveals much about what appeals to us about the field. Go view an Okapi in the zoo and then read the heated debates of those who advocated for its existence and

non-existence before it was discovered in the jungles of Cambodia¹⁰, and you'll see that this animal lost much of its star-power by being discovered. The real power of cryptozoology is in the magic of the unknown and play as a way of interrogating that unknown.¹¹

Cryptozoologists and plain old zoologists alike enjoy a good expedition. The themes of expeditions, of far-flung searches, and the accoutrements of such interest me greatly. This is partially because I am drawn to make work for wild contexts that cannot be found in cities and certainly cannot be found indoors but have spent most of the past few years forced by circumstance to mostly work in the latter places and thus only reference the former. As I'll talk about later, I did spend some time trying to initiate a linkage between gallery-based works and urban wilderness works through audience expedition with only partial success. However, as with anything, one can try to distill an idea into something that can exist in a typical gallery. An artist who I think does this well is Panamarenko, who makes sculptures that act as purported vehicles and equipment for and/or residues of adventures and expeditions which Panamarenko alleges he's taken to places like the bottom of the sea and the clouds.

¹⁰ Incidentally, as is typical in such cases, the people who historically shared the Okapi's habitat knew it was there all along.

¹¹ Sometimes I even suspect that the folks who popularized the whole goatsucker myth, did so just for play. The goat seems to be a font of playfulness for people. It's their legs that get attached to the most playful of chimeras: Pan, and the most mischievous, Satan. Perhaps it's because they've got such weird eyes?



Figure 22: Pepto Bismo (2003) - A recent version of an ongoing project by Panamarenko.

As I alluded to earlier in this thesis, an object that moves or, even better, has behavior becomes very alike to an animal. These are the kinds of objects I make and therefore I am interested in the work of artists who have experimented with objects as behavioral entities even without movement. Notably, I like very much a piece by Claes Oldenberg where a piece of pie is shown in about 8 different three-dimensional frames of what amounts to an instantaneous series from a stroboscopic high-speed film of a piece of blueberry pie *à la mode* in the act of flying - flying in the way pie would fly, with the ice-

cream ball used for balance while the top and bottom crust flap. I think Oldenburg strives for a new sublimity through absurdity in his objects. I seek a new sublimity, perhaps even a new romanticism.



Figure 23: One of Hubert Duprat's caddis fly larva projects.

In Hubert Duprat's caddis fly larva projects, the artist provides the larva of the caddis fly (which will use anything nearby in the construction of its cocoon) fine jewels and precious metals that the larvae dutifully weave into their cocoons as they are as good as anything else. Despite being natural materials, the form of the gold and jewels has the human hand in it and the net effect is one of a juxtaposition of a natural process with artificial materials which at the same time begs the constant question of how much really are man's makings unnatural. Where is the line? Why is plastic perceived as so foreign to nature when it is made of organic molecules by a natural entity? There are plenty of good answers both ways but the question put in physical form remains compelling for me. Other animals build structures that change the face of the landscape, other animals discard waste into large piles, other animals make, use, and abandon equipment/tools but at some point our instances of doing these things became unlike theirs. What is truly natural? I am partially trying to explore this with my projects. Robert Smithson's work

is compelling to me because he highlights the mental categories of artificial and natural materials and evokes visceral responses from combinations thereof. When he pours glue onto the hillside, it's the dirt that seems like the impure thing, the pollutant. Moreover, there is a mental double-take in the subsequent thinking about whether glue really is that foreign to the natural world.



Figure 24: Robert Smithson "Glue Pour" (1969)

Once you begin to leave behind the puerile fantasies associated with animal characters, mythological animals, and less-likely cryptozoological animals, you begin to want to really get down with real animals. There are a very few animals who are evolutionarily so closely related to us that we can expect them to have similar signaling pathways. Although early experiments intended to teach other great apes our vocal languages were eventually frustrated by those apes lack of appropriate larynxes, later

experiments with sign language and eventually lexigrams have met with some success. But when it comes to other animals, even other mammals, it is clear that they likely perceive the world differently than we do and are responsive to a different set of signals. It begins to look reasonable, though, that just as other traits once reserved to humans, like problem solving, tool use, and self-awareness, have been shown to have equivalents, perhaps often of a lesser degree, in other animals, that consciousness and perhaps even aesthetics exist in other species. However, if you want to commune with animals (and I do) you have to try as best you can to imagine what it is that a species responds to. Whereas, Thomas Nagel argues in “What Is It Like to Be a Bat?” that basically you can’t imagine this with any fidelity, the robot provides the possibility of making something that can (1) be made to have suitable size and form for the animal in question to relate to as it relates to others of its species and (2) potentially, eventually, learn and mimic the animal’s signals. To the degree that such a robot is an extension of you, you can commune with the animals.

I want to relate and help others relate to animals in a deeper way. Charles Darwin, of course, almost completely closed the categorical gap between humans and animals with his *On the Origin of Species*. For sexual animals, the repercussions of his theories were even greater: every sexual animal is an Xth cousin Y times removed of any other sexual animal which means when you are watching a pileated woodpecker in the swamp in Georgia, you are observing a literal cousin, a backwoods hick of a cousin who’s a little on the stupid side by city folk accounting but who can drum up a mean tune on a tree trunk and make a pretty good country living doing things the only way he knows how.



Figure 25: Your cousin.

2.2: Kinetic and Robotics Artists

My early interest in kinetic art was motivated by work by Alexander Calder and Christian Marclay. I had seen numerous Calder pieces as a child and the primary aspect I

responded to, especially in his stabiles, was the idea that the materials and processes that were used to construct the staid and standardized forms and systems of the world we lived in could be, literally and figuratively, bent for a different purpose. I may have had a precocious ennui with the banal or perhaps even an unimaginative relationship with the aesthetics of the ordinary, but the Calder work, and also non-kinetic work like Serra's that I encountered without knowing the maker's name, spoke to my child's mind of a promise that the ordinary could become unordinary and that unordinariness could have physical form in the world and not just exist in words and images.



Figure 26: Alexander Calder's "Stabile Rouge"

I encountered Christian Marclay's "Tape Fall" at the Hirshorn museum in 1990. The piece is comprised of a ladder with a reel-to-reel tape deck sitting on its highest rung playing a recording that sounds like water dripping. As the tape plays it is not re-reeled but instead allowed to dribble down to the floor so that, below, a pile forms. I interpreted

the recorded sound as that of mineral-rich water dripping from the roof of a cave. I was excited that the tape that bears this sound was also becoming the sculptural material that through its being played forms a representation of the stalagmite that would be formed by that dripping in a real cave. That Marclay may not have had cave stalagmites in mind but instead puddles and waterfalls matters little, I was compelled by what I understood of this piece, how I understood it, and the meaning I took from it regarding representation. I liked that once again something had been made into something else merely through placement and arrangement of the physical. I liked that a functional movement - the tape reeler reeling - had been likewise turned into a very different movement.



Figure 27: Christian Marclay "Tape Fall" (1989)

As an undergraduate, while being exposed to the freshman art cannon of Cindy Sherman and Vito Acconci and their peers, I discovered Arthur Ganson, outside of class as the MIT museum had many of his pieces. Ganson seems to be a fairly marginalized figure in the art world. One gets the idea that his work is viewed as trite and unimportant

but it is remarkable how many contemporary kinetic artists cite exposure to his work as a seminal moment. It seems they are often later taught to discount it. I imagine that it is something about the man himself and perhaps the tack he has taken that has caused him to be stigmatized. The work is elegant and imaginative. Moreover if one can be forgiven adding a progressive ideal to one's own experience, it seemed like the very next step in my understanding of what was possible with kinetic art: choreographed gesture. This was not the unscripted motion induced by natural phenomenon that was the hallmark of Calder's mobiles and of work by those who followed his lead. It was deterministic, intended gesture wrought through meticulous hand-construction of mechanical systems.

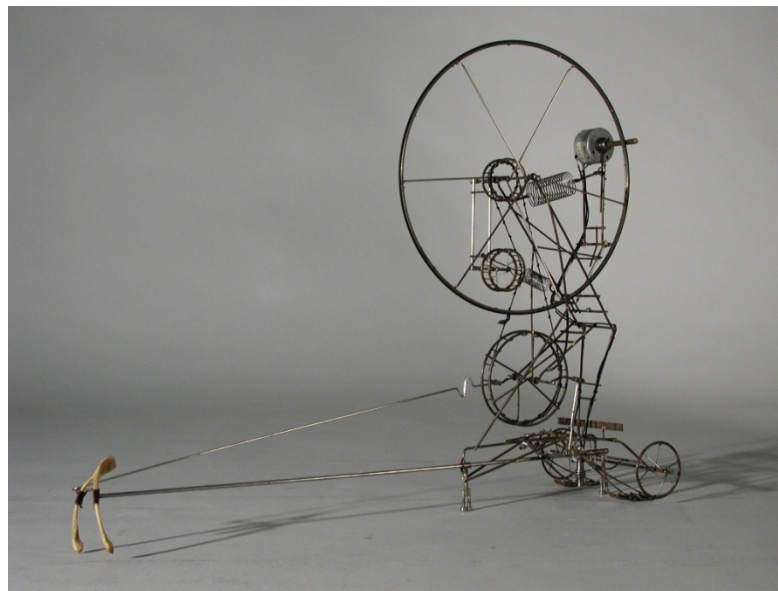


Figure 28: Arthur Ganson "Machine with Wishbone." A mechanical cart of bent wire powered by a small DC motor provides the motion to a chicken wishbone to make it walk, pulling the cart behind.

In his "Machine with 23 Scraps of Paper" Ganson took the ordinary - ripped pieces of paper - and made them fly like a flock of gulls, making the gesture outline the representation. In "Machine with Oil" he made a machine that was built for the single function of lifting oil out of an oil pan and pouring it on itself, the result being that it was

kept well-oiled allowing it to perform its function effectively which was...you get it. The first might be dismissed as a mere representation and the latter a conceptual one-liner but for me they were another example of how magic could be teased out of objects, including objects that were mainstays of the mundane. In fact, I still find myself uncertain whether I see more value in a rich and layered and perhaps even exquisitely ambiguous piece or the simple piece that generally communicates one succinct idea. I think there is a time and a place for both and even in the latter case, an interpretative range is possible. More importantly, I defend the value of work that is entirely for interpretation through what is garnered in the experience of contemplating the work itself i.e. without external support such as writings.

Much later I encountered the work of Jean Tinguely. Here I saw that Tinguely was obviously a strong influence on Ganson and hence that Ganson had by no means come out of nowhere. Although Tinguely's early experiments had been in precise deterministic movements applied to abstract forms, he segued for a period into using motor-driven determinism to excite random systems that resulted in the gestural equivalent of turbulence: patterned randomness. These were often playful experiments involving a range of industrial and organic materials and even toys. Tinguely had an intuitive understanding of his materials and mechanisms that resulted from his hands-on approach to making his machines. His mechanistic sophistication remained limited, however. He discovered the crank mechanism and he spent his career worshipping its ability to turn rotation into linear oscillation, and would layer cranks upon cranks, with belts as the glue, to build up a hurricane of motion from the input of a single motor. I think his work peaked when he left behind the rawness of his found materials and unified

them in black to make the focus the gestures of these thrashing, thrusting machines. However, at this same time he began to tread into two now well-explored jungles of machinic art, perhaps as a pioneer but nonetheless as one blazing a primrose path. The first is succumbing to the inherent tendency of machines to lend themselves to violent gestures. In his “Hannibal” pieces and others like them you can see this trend.

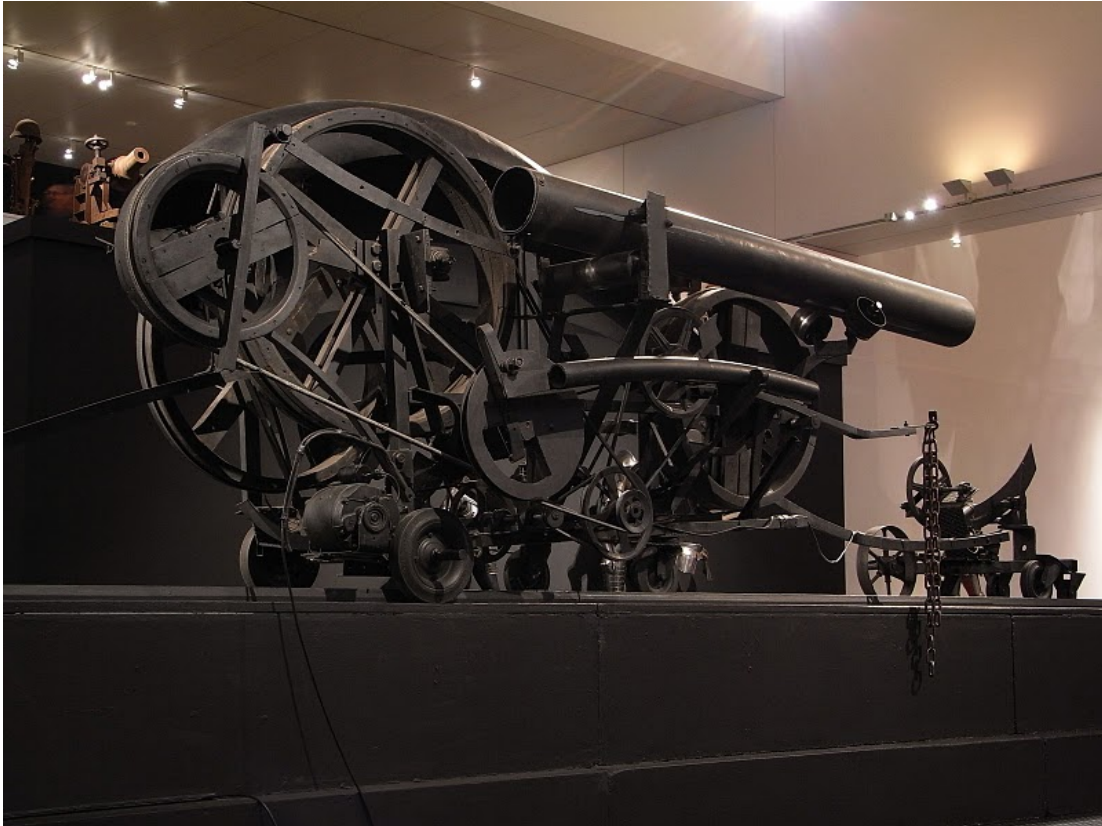


Figure 29: Jean Tinguely's "Hannibal II", a thrusting, stabbing, clanking mechanical monstrosity.

The second trend is to capitulate to the difficulty of getting machines to work and then taking as a theme that failure. “Homage to New York”, a large-scale installation that over the course of its first running destroyed itself, is an example.

However, Tinguely was bold in his experiments at the border of art and his pioneering of such, now pervasive, ideas as the machine as art, the machine that, beyond

being art, “makes” art and the assemblage of industrial junk into a gigantic nonsense mechanism.

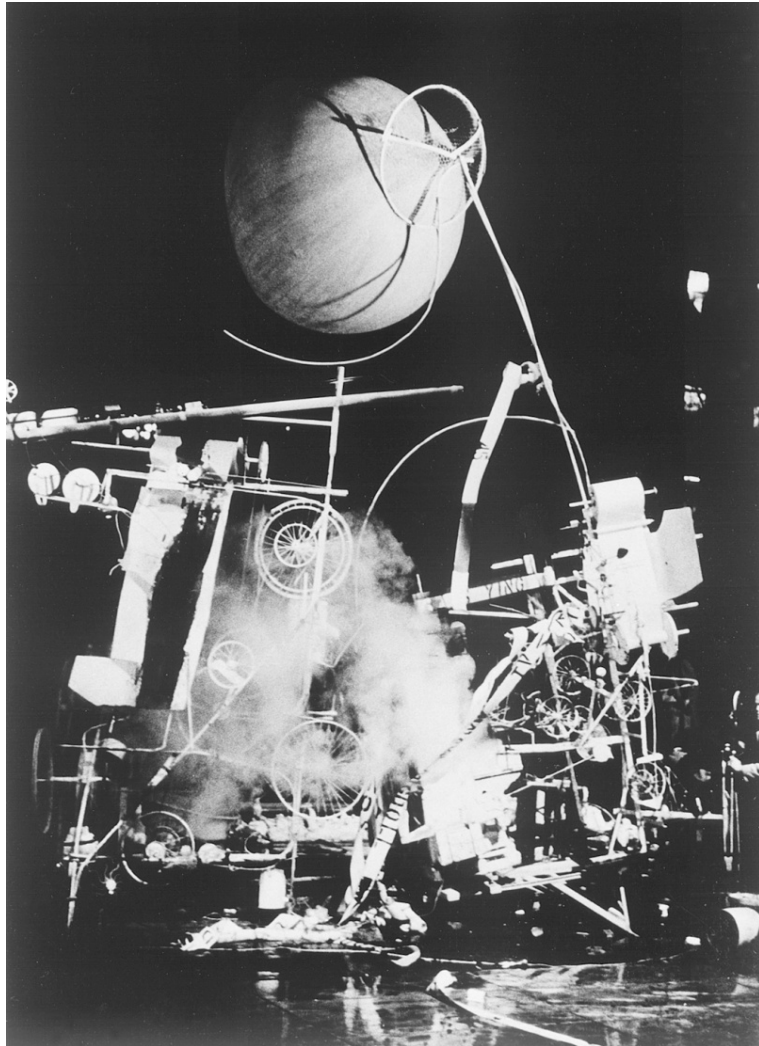


Figure 30: Jean Tinguely's "Homage to New York"



Figure 31: Fiery mayhem and destruction at a Survival Research Labs performance.

Survival Research Laboratories (SRL) are the most well-known contemporary practitioners of that aforementioned tendency to relinquish control to the machine's will to destructive gesture and action. They position their uncontrolled, violent performances as deliberate critiques of society and the military-industrial establishment and the kind of technology and techno-culture those produce but their projects can smack of adrenaline-charged macho energy where the stated cause is very much secondary. I certainly grant them their place in the kinetic/robotic art narrative but it is disappointing to me that the narrative of robots has yet another chapter on violence. There is in their literature frequently a declared aspiration to re-direct technologies away from their intended

functionality in an overly function-oriented and aggressive society but the tacit extrapolation that somehow this can effect change in how that society justifies, develops, and uses technology seems irretrievably disconnected from what they actually do. They are literally fighting fire with fire. I have in the past espoused a similar goal of re-directing the human will to invent away from competition and aggressiveness towards play and empathy but that has slowly revealed itself to me as a extremely complicated project that arguably has been ongoing for centuries, if not millennia, the proponents of which are less revolutionaries than an abiding sector of society that provides a foil to the other ones. I wonder sometimes if SRL's projects act to support this latter sector or a different face of the violent one.

I think some of SRL's decisions are the result of thinking that is strongly tied to a certain set of neo-sci-fi-like ideas that pervade current culture. No one, however, evidences this tendency more than Stelarc. Stelarc is the visual art equivalent of the cyberpunk authors of the nineties. He takes some of the more ubiquitous notions from science fiction and makes them as real as he can. Perhaps intentionally, his work is most successful in its making these notions seem abjectly grotesque. He presents an image of an extension of Marinetti's blindered glee for a culture centered on technological advancement, one that is just as rife with risk of foolishness now as our society blunders into new sources of technological hubris as it was when it supported Fascism.

A sometime kinetic artist whose work I admire a great deal is Rebecca Horn. Whether she builds her machines herself or not, their capacity for ripe gesture delivered by an economy of material and mechanism is unsurpassed. Whereas Ganson's machines

speaking to a sublimity wrought from matter, Horn's do this and are moreover wrapped in the human emotional veils that baffle yet augment our relationship with the sublime.



Figure 32: Detail from "The Lover's Bed" Rebecca Horn (1990)

I am inspired by kinetic and robotic artists who are in an entwined relationship with their materials. In being responsive to the materials of machines they control the medium of machines. Survival Research Labs work with their materials and know them (and have the injuries to prove it) but don't seem to want to execute much control and thus make kinetic work which has a certain monotony. Someone like Tim Hawkinson, on the other hand is deeply engrossed in the making of his work, in trying to get what he wants from the materials, and responding generatively to the push back of those materials. If he decides to make a kinetic piece to realize a given idea, he does what it takes to coax what he wants out of the material, sometimes making a system of very unlikely materials yield a nearly impossible coordination, sometimes seeking out the components that are necessary for a piece. His machines are a method he uses to explore

the issues of body and system that he is interested in rather than methods to explore machines themselves. The mechanisms gain a sort of transparency in their mechanical facets even when they are completely exposed. They become almost purely sculptural while still functioning to add the gestures and movements to the other parts of the piece.



Figure 33: Tim Hawkinson "Emotor" (2001)

Theo Jansen has a similarly deep and fecund relationship with his material which for quite a long time was almost exclusively the plastic electrical conduit common in his home country the Netherlands. He built impossible complexity out of this material to realize his beach-walking behemoths. Their transfixing elegance is the substantiation of

that struggle with and against the material. I see a similar elegance in Sabrina Raaf's work with machines that seek gestural and behavioral essences in artifacts like felt-tip pens and calculators.

The innovative robotic sculptor, Norman White, is an advocate of sculptural behavior as a new medium made possible by robotic technology. He often uses a deliberate tactic of contrasting the behavior of his pieces with their form to bring to the foreground that behavior as an appreciable artifact, as something with potential aesthetic qualities. His strategy and concept with the "Helpless Robot" was to engage audience members in a familiar activity- responding to a request for help – and thereby build up observation of intent and inquiry by the audience member even though the piece had no agency besides the ability to make utterances.

Natalie Jeremijenko has, amongst her various projects, made some kinetic and robotic works. These usually take the form of evocative prototypes of a conceptual work. An example is her "Feral Robotic Dogs" project. The idea is to re-purpose the army of toy robot dogs that are *de facto* embedded in our midst to sniff out polluters by re-configuring them with appropriate sensors and re-written code. It's a playful fiction and the pretence was made more rich by actually doing some hacker style re-configuring of the toys to outfit them with simple chemical sensors, disseminating instructions on how to do this, and encouraging proliferation. However, some of the writings about the project intimate that the packs of dogs have the potential to become an effective solution to the problem of making hidden pollutants salient and uncovering illegal polluters. What they are instead is an effective way of playfully engaging people in the idea of these problems and that such problems need solutions. Ultimately, though, that solution will

take a much different form. The project is really that other kind of gesture: a small, adroit, suggestive proposal. Such gestures can be powerful art but the implication of efficacy in this case undermines the potency.



Figure 34: Natalie Jeremijenko's "Feral Robotic Dog" project in action.

Jeremijenko's multi-pronged OOO project demonstrates her interest in the reconsideration of animals. There is no doubt that we are kindred spirits in this regard. There are even passages about urban animals in the OOO literature that are echoes of things I wrote when making *On Beyond Duckling*. I enjoy the project's verbal campaign against the standard sites and protocols of human/animal interaction but I find myself frequently confused when reading the details and looking at the pictures and videos about how they work to fulfill the mission. If the audience were only being asked to delight in

a mix of imagery, words, notions, and playful acts, the project would come across as a tight series of topical, fanciful proposals, but they are being told that there is more effect in these actions than there is, in some cases that these actions constitute science, and more dangerously that maybe that science is better than that being done by scientists¹².

In one of the OoZ projects, she and collaborators instrument goose decoys so they can be remotely controlled by humans to move around a pond in the vicinity of live geese. In her more recent writings about the project, she even touches on ideas about bridging the gap between humans and animals through this project. Now that buttons can be pushed by the person at the helm of the robo-geese to play-back recordings of goose sounds so they can observe reactions of the geese through a camera, there is a suggestion of the possibility of communicating with the geese or of even learning something about their communication.¹³ While the scale of the machine and its disguise in the hard plastic

¹² How much does science, art, and more importantly humanity stand to benefit from the current conflation of art and science? I am obviously all for technology in art and art that references science but I am really resistant to this neo-dogmatic chant that science and art are the same thing – a dogma which is central to some of Jeremijenko's positioning. To give in to a thought worthy of a conspiracy theorist: might this rhetoric be an insidious part of the ongoing campaign of some political factions to discredit science? Less conspiratorial: if not, might it be helping that campaign anyway?

¹³ I have also read OoZ literature that describes a future database of recordings of the geese coupled with interpretations from the human audience of the vocalizations based on the latter's sense of what was going on when they were piloting the robo-geese.

Jeremijenko claims this might be a better method than rigorous experimentation and

form of a goose may allow for this project to give the human controller an interesting kind of telepresence, it is neglectful of a number of facets of the territory it exists in. It is guilty in its implementation of the same blindness to animal reality and circumstance that is claimed in text descriptions to be its target. Its choices are more about the human eye than the goose eye with the result that it is more re-purposed, instrumented hunter's decoy than goose communication tool. Arguably, decoys of the kind used are only mistaken by the real animal at ranges greater than a few meters. Any closer one would imagine that it would enter the uncanny valley of goose-ness¹⁴ but even if that were not true, in its movement, gestures (or lack thereof) and behavior it is very un-geese and not un-geese in a way that is particularly elucidating. It finds itself in the domain of animatronics yet misses the opportunity to engage with the weirdness of animatronics as another limited representation. The robo-geese ends up existing in a dissatisfying realm of the space between artwork, science instrument, and telepresent body which is otherwise a very interesting space indeed!

observation by scientists of learning about goose communication. There is certainly a kernel of a possibility here (e.g. crowd-sourcing to leverage the power of human perception to create richer datasets) but this project as it is currently framed is a little loosey-geesey!

¹⁴ I have seen video of real geese and what look to be some sort of tern reacting to the motorized decoy in a way that suggests there is some substance to this idea. The terns are doing very agitated, defensive dives on the robo-geese. Of course, it could be more about where the robo-geese had been driven (vis-à-vis nests etc.) than its appearance and behavior.



Figure 35: Version of Natalie Jeremijenko's "Robotic Geese"

There are other OOZ projects that seem to fall prey to the same anthropocentric worldview that OOZ is supposedly critiquing. For instance, Jeremijenko made pigeon perches that when alighted upon play back human-language appeals on behalf of the pigeons, worded so as to seem to be in the voice of the pigeons themselves. Jeremijenko defends this unmitigated anthropomorphism as merely the way humans relate to their world but it's the fact that we should realize that other animals are different than us and share our world in their own way that so greatly needs to be broadcast, a point she makes verbally elsewhere but the project itself does not serve. If anything it's the absurdity of the blatant anthropomorphization that could make that point but in this project it is not played up in the right way (in the texts broadcast for instance) to make this resonate.

3: Discussion of my Work during the Program

I came to CMU very interested in the unreal. I had spent most of my life a fantasist, a person for whom, even as a child, the real seemed fatally lacking in richness. To me the best of human life lay in adding layers of fiction and pretend into the activities of the everyday. I injected fiction liberally and in the year proceeding my coming here as I operated at the fringe of society and the first year I was here, that tendency ramped up, peaking in the Spring term. I'll address that peak later but first I'll sum up my time at CMU as three processes related to my relationship with fiction. The first was a gradual move away from invented narrative with some influence from natural systems to narratives more deeply wrapped up in the un-invented details of natural systems. The second was a move away from narratives that were mostly constructed by me to narratives that could be completed by the pieces themselves as they functioned and/or by the observer. The third was a move of the fiction out of my head and into my work, a process that may have been good in some ways but leaves me feeling much less content with my mental self.

3.1: **Schrecktier**

Ignoring all my small projects and unfinished experiments, I made two projects my first year. The first was *Schrecktier* (2005). If one could say I had a goal for the project (or at least had a retro-active goal once it was nearly done and I was trying to figure out why I did what I did), it was to find a way to make a machine function as a residue of a narrative. I also wanted to have the narrative be a kind of allegory, an

outcome that I find less interesting now. I made a machine that moved a handful of leaves in a way that was like the breathing of a small animal and gave it a range-finder so that if someone approached, it would “become alarmed” and breathe harder at certain threshold distances up to the point at which it could be described as “freaking out.” I showed it along with torn out pages of my journal and Polaroids that chronicled how I had found it high up in a tree and decided to cut it down to take it home (in far more words). How it had gotten in the tree was left open-ended. In the context of the show it was pretty clear that I had made it and I think it may have been difficult for some people to suspend disbelief and go along with the story while viewing it. So I modified the story. The next time the premise was that I had found a plant/fungus/animal growing in a tree that had the same un-plantlike animated-ness and behavior described before, that I had cut that down and taken it home with it freaking out the whole time, that it had subsequently died and withered to the point of looking like a desiccated house plant and that THEN I had built a machine to replicate it. The real crux of the allegory was that, whereas the original creature had never stopped freaking out, my mechanical version would eventually calm down and start to make conversational movements i.e. be friendly i.e. fulfill through artifice what the me-character who cut it down had hoped would happen with the “natural” original. I showed this at an out-of-town show and for the days I was there for the opening and for a talk, pretended it was all true.

Sculpturally, the project was partially successful in amalgamating the natural materials with the mechanistic, something I am always working at, although it had too many unwitting references to the style of steam-punk and I over-worked it by making

casings that covered the functional elements of the machine when in this case exposing them would have been better.



Figure 36: Schrecktier, a mechanical reconstruction of a cryptobotanical plant that breathes like an animal and becomes frightened when people approach.

In my opinion the story had improved - the right kind of mix of something like Pinocchio, Frankenstein, and something from the field journal of a cryptozoologist who unexpectedly finds their cryptid quarry – and people bought into it more too. In fact, the real lesson of the piece for me was how much some people bought into it. Actually, “bought into it” may be the wrong phrase because it implies volition. During the opening reception and during the talk, it was clear that to varying degrees people really thought I

had found something in the woods like what I described. Some thought I was twisting something that already existed but some plain-out thought that there was a strange plant in the woods that behaved just as I was saying, that there weren't many, that it wasn't widely known, and that I had found one...and through my selfish behavior, killed it. I felt strange about their trust, and strange about my maintenance of the pretense. Not to aggrandize the progression of my thinking by comparison but I was paying a lot of attention to how fiction was being used by the executive branch of the United States government to disastrous and awful result and it was leading me to re-consider my whole relationship with fiction. Surely, it was important to make sure that in a game of pretend, everybody involved knew we were pretending, was it not?

3.2: On Beyond Duckling

I decided to make a machine that had a story that it played out instead of being an object in a story that had already happened. I had been interested in the idea of creating an artificial symbiosis for a while, the idea that somehow I could make an anthropogenic system and wrap it into a tight relationship with a natural system, perhaps even a vital one, either by replacement of one entity in an extant symbiosis or, optimistically, by creating a whole new symbiotic relationship. Having realized just how difficult a true realization of this idea would be from experiments and thinking I had done, I decided to try mere cohabitation with this project. The machine would exist in a wild habitat with wild animals and engage in its activities and perhaps the activities of the animals that were also there would become entwined in the story. I wanted to further explore the mixing of the natural materials with the artificial. Despite my concern, the leaves on the

Schrecktier machine had survived more than a month of constant rustling. Of course, the leaves on trees make it through a lot more rustling than that - albeit with the benefit of a water and nutrient supply that the fallen leaf does not have- so it shouldn't have been that surprising. I became interested in the functionality of such materials. Most animal structures are functional structures that natural selection has guided through the hyper-dimensional space of the physically possible and grow-able towards great efficiency, if not optima. Therefore often what appears fragile is really robust. The flight feathers of a bird are light-weight but they are also capable of withstanding relatively large forces, as they must in their aerodynamic role. In that I also wanted to explore unusual locomotion as a source of meaningful gesture, I thought I would try to twist the functionality of some animal objects into playing a different functional role in a machine living out a narrative

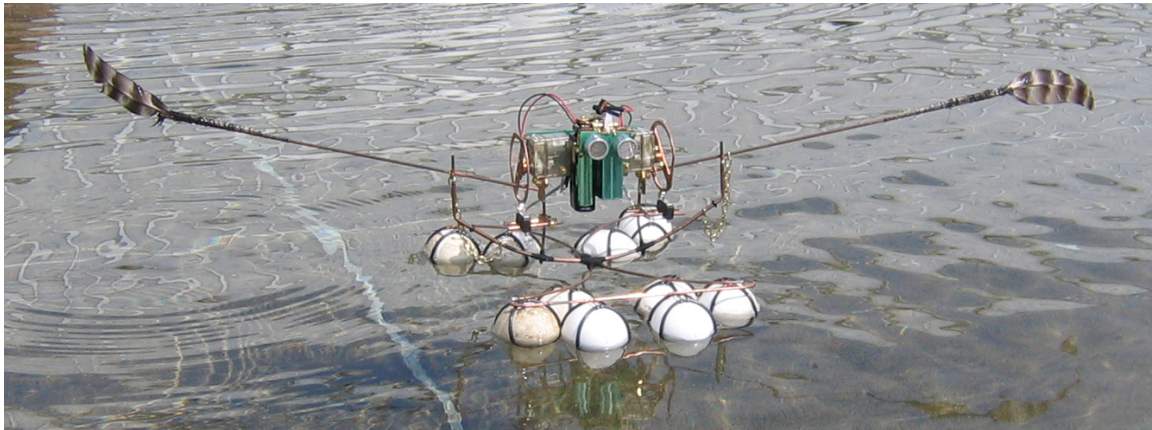


Figure 37: On Beyond Duckling - Electro-mechanical duck surrogate performs mating ritual in center of pond using echolocation to find that center. No mate exists.

in the wild. I built the *On Beyond Duckling* (2005). I was trying to create a visual and narrative mix of children's story-related ideas (specifically some related to Hans Christian Andersen's "Ugly Duckling" and Doctor Seuss's *On Beyond Zebra*), ideas related to actual animal behavior, materials that connected the fictions of the children's

stories to real animals, and a little bit of a discussion of the human relationship with fictional automatons like Frankenstein's monster and the Terminator. The result was a "species" of urban mechanical waterfowl that had feathers for oar blades and blown-out eggshells for pontoons that forlornly rowed around a small pond looking for a mate, using echolocation to avoid obstacles and to navigate to the pond's center where it would perform an elaborate courtship ritual intended to attract its mate, a mate that had not been built.



Figure 38: On Beyond Duckling from above.

To me the machine was like Frankenstein's monster except woefully weak and pathetic where the monster had been very big, strong, and ultimately horrific. My story for it and the monster's story are very similar including their desire for and lack of a

mate. Simultaneously, the *On Beyond Duckling*'s fake plight reminds me of the last Great Auk (or Thylacine or Golden Toad or what-have-you) that, not knowing the futility of its efforts or its state as the last of its kind, progresses with its animal searches and activities and its will to exist and procreate right up until the moment it dies. That is how the project is for me but I think this project was particularly successful in its inviting so many other narratives from viewers. And, as hoped, the animals that it shared the pond with did not ignore it. Not surprisingly, dogs took much interest. Relatively unsurprisingly, real ducks gave it a wide berth, even going so far as to get out of the pond when it was there¹⁵.

The most compelling response came from the orange Koi carp in the pond. During a particular session, as the *On Beyond Duckling* was rowing towards the center of the pond, a large group of the Koi were floating together in a splatter of orange on the other side. All of the sudden, a fish left the group and was followed by another and that one followed by another which gave the effect of a string of knotted yarn being unrolled from a ball. The lead fish was heading towards the machine but some feet away it turned to begin an arc around it. However, as the fish circled, it drew closer, all the while the line of fish behind it drawing out its path. At the final instant as the lead fish came up and lightly mouthed one of the eggshells of the machine, the result was a spiral¹⁶ of orange Koi laid out around the *On Beyond Duckling*. An instant after that, they scattered.

¹⁵ This begs for a controlled experiment with many variants to see what in particular they were responding to and whether some versions might be treated with less suspicion. One wonders whether the ducks found something uncanny about this machine.

¹⁶ Perhaps it was even a Fibonacci one.

I am not sure what about the machine elicited this response. I have never repeated it. But for me it was as if the machine had unlocked something in the behavior of these fish. Something about its way of being there, its way of moving, had triggered a sequence of stimulus responses and geometric relations with the result being what might be called a machine/animal mandala.

3.3: **Blackout Bugaboo**

I made four projects that I exhibited my second year while spending a lot of time on projects that never got done. Of the four that were shown, *Blackout Bugaboo* and *Piscatawamass* again fell into the territory of constructed narratives about imaginary entities. Without going into details, *Blackout Bugaboo* (2005) was a failure as the narrative was over-wrought and superfluous and too fantastical without gaining benefit from the fantasy. Its only slight success may have been in its use of found objects to make something marginally interesting sculpturally and gesturally but it was almost a creature in the Jim Henson sense of the word and that is not my goal.

In the way that Elmo is animal-like in only the most basic of ways, he is, as he admits, a “monster”, one of the many types of entities in our culture that are born more of the fictions that float around our relationship with animals than from attributes linked to an understanding of animals. Kermit the Frog is an entity only slightly closer to the latter on this axis. Things on this end of the axis are in abundance. I feel a pull towards the other end. *Blackout Bugaboo* was on the wrong end.

3.4: Piscatawamass

As might be evident from the *Schrecktier* piece, I have always been interested in cryptozoology. I had in fact decided to pursue Ocean Engineering as an 18-year-old with the intent that I was going to learn the skills necessary for joining the search for the Loch Ness monster and later, having partially shifted from complete cryptids to the seemingly unattainably elusive, I formed a group of marine robotics friends, Deep for Cheap (DFC), with the goal of searching for *Architeuthis Dux*, the Giant Squid. DFC never became anything close to a full-time gig and moving to land-locked Pittsburgh had been a nail in the coffin of DFC but I still harbored an interest in elusive animals and the aura of mystery they produce. We are drawn to the edges of the known perhaps because of a curiosity that has been useful to our species but also perhaps because the unknown is related to the numinous.

I had a related interest in making projects that put wrong ideas into the heads of children. The motivation for such an apparently iniquitous goal may be hard to pick apart but the notion was to present complete fictions in a sheep-skin of seeming truth where the wool was an authoritative voice of one sort of another. We all have wrong ideas learned from some misunderstanding, hedged answer, or bald-faced lie told to us when we were kids that we don't learn are wrong until much later and that in some cases are semi-foundational to our worldview and/or even induce a sort of cognitive dissonance in situations where the truth on the particular matter is thick in the air of an activity or discussion. I think these are sort of great and wanted to directly seed a few or at least go through the motions of seeding some because it seemed like both a sort of profound joke and a sort of gift.



Figure 39: Fabricated time-lapse footage of a cryptobotanical plant that reproduces via fire-chain-like seed passing process, found and filmed in 1954 by Danish naturalist Søren Henkelberg.

I had this particular project in mind for years and began it my first year and then completed it rather hurriedly with Bum Lee and Amisha Gadani when I got a short-fuse opportunity to show in the second term of my second year. The idea was to create fake time-lapse photographic film of plants that did things no plants did and install it in a well-trafficked place like an airport perhaps with an appropriately authoritative voice-over akin to David Attenborough's. Over the time I was actively making the project, I was involved in that aforementioned inner dialogue about fiction, its role, the extent to which it should be used etc. I ended up deciding because of experiences like I had had with *Schrecktier*, that I would make this new piece, at least that time around, in such a way that it wasn't hard to sense that this was a fiction, so the audience could delight in the pretend, not be duped, but still be induced to think about their epistemologies as they related to authoritative voices. I therefore invoked cryptozoology, or rather cryptobotany (a term I think I made up), not just because I am drawn to it but also because I think most people engage with it as a kind of play.

The form this project took was *Piscatawamass* (2006), a piece of faked time-lapse photography of a fictional cryptobotanical plant supported by a few props associated with the expedition that had taken the time-lapse – a burnt journal with sketches and traces of historical and biological information about the plant and a letter from the Explorer’s Club in New York declaring their financial support of the expedition - objects supposedly destroyed in a fire at a Danish museum and found in my Pittsburgh attic. The plant itself was an exceedingly rare species known to be present in the Allagash wilderness in upper Maine and parts of nearby Canada that reproduced collectively by passing individual seeds one by one down a long chain of plants through slow thigmotropism, each plant adding part of the genes required for the seed to develop into a new plant.

The project worked out fairly well and it succeeded in involving people playfully in the fiction. Two major things came out of it for me. The first was simple: in the process of looking more into plants to design the *Piscatawamass* plant and in conversations with folks who saw the project, I was continually reminded of just how many incredibly oddball things plants in nature already do. Nature is weird. Is made-up nature maybe even a little less fun than exploring what nature already is? Maybe there is some middle ground where the made-up and the real can come together in a more exciting way. The second thing was that I learned of a lot of projects tightly related to mine. At some point during my first year, I had learned about the Museum of Jurassic Technology in Los Angeles. I can’t remember when but I eventually read “Mr. Wilson’s Cabinet of Wonder”, a book about the Museum and its creator. Not as if a door can be closed on an idea of this magnitude but it was clear from the book that the door was definitely already wide open: this museum was an exercise in the very kind of world-

warping bathed in the authority of the scientific presentation that I had been thinking of and more. Again, the idea is big enough for more than one person's work but I was, as mentioned, already struggling with my relationship with fiction and a growing sense that perhaps there was too much fiction in our society already so learning the door was this open already tempered my enthusiasm for such projects. Such work might be thought of as just a headier food for our society's unbridled hunger for fiction. Disney cartoons and Hollywood movies might provide the fast food and David Wilson's work might be akin to eating delicacies but maybe it was still a part of an unhealthy dollop of meaningless fiction. I had sometimes thought that such deep fictions might act to put people on their guard against the use of authoritative posturing to administer more harmful fictions, maybe even act as a kind of critique of people's lack of healthy skepticism but if that were true then the work would fall prey to the pitfall of all would-be critical art: the means is very ineffective towards the end when compared with other means.

3.5: Whole Other Kettle of Fish

My classmate, Lauren Adams, lived in a place with a store-front window that she had been talking about using as an informal show space ever since she got to Pittsburgh. Half way through our second year, we decided to make it happen by having Thomas Sturgill and me put something in it, namely *Whole Other Kettle of Fish* (2006).

I had decided to move away from fictions for the time being and engage more with gesture and behavior as things standing on their own without back-story or much story at all. I had two central goals for the piece: to take something that when static had very few associations but when moved with a particular gesture became a simulacrum of

another thing and to make something that was interactive but primarily with people who didn't know they were being interacted with. In this case, we used slabs of rubber that Thomas cast to make a school of slabs, a slab school, which had the appearance of a feverishly swimming fish school when motors above twiddled the thin rods the slabs hung from like mechanical marionettes.



Figure 40: A school of ten rubber slabs swims to the right or the left. If someone walks by the window in the opposite direction with little deliberation in their step, enough gusto in their gait, the slabs will turn and swim in that direction...until another seeming leader comes along and turns the fish back around. Please don't tap on the glass.

I figured that since we live in an age where the real and the authentic have been replaced by the perceived and the seeming, where we have CoffeeMate for cream, NutraSweet for sugar, and Facebook and MySpace replace people's need to look at real faces in real spaces that rubber slabs seemed an adequate replacement for actual, living fish. These were fish substitutes, the NutraSweet of fishiness: NutraSwimmers!

These NutraSwimmers were aimless, though, and needed a leader so a vision system tracked activity outside the window. When people walked by on their way to or

from work, if they did so smartly and in the direction opposite to that in which the school was currently swimming, the slabs would turn around to swim in the walker's direction.

3.6: Stuttering Magpie

I came to CMU intending to make things in wild, remote places - sometimes only viewable by audiences as documentation – but was gradually corralled into the gallery and regular art venues. On the upside, it was a new perspective for me. I had never shown in galleries, it was outside my bailiwick, and it had a mysterious aura. On the flipside, it was very constraining, I was under-prepared for it, and I made a lot of mistakes. Since my machines were intended for rich environments and galleries are intentionally devoid of richness, I mistakenly found myself trying to build environments for my machines, sometimes thinking of this as somehow related to the idea of domestication or of the caging of wild things. This took a lot of work and hence time away from things I cared about more, and I didn't really have the skill-set to pull it off effectively. In particular, I made a few ponds for the *On Beyond Duckling* which took forever and were never quite good enough. The gallery also asks for a greater attention to detail since sculptures can be inspected at close quarters and have to be considered in the round. In a video, the situation is different. Not that my machines are like special effects for screen-based media that are designed to do just the right thing in the frame from just the right angle, with the camera-work done to avoid zooming in on the part that never looks right but that needs to be as it is for the machine to work and can't be changed without some unreasonable lost time. In any case, I think there was a net benefit from beginning to put things in galleries and falling in various pitfalls and

struggling with craft. I knew though, that even if I continued to make gallery work, my primary venue would be the true wild, where I would have audiences of very few, if any humans. I decided that I would try to connect the dots, that I would make a gallery work that was connected to a wild work and try to use the former to bring an audience to the latter.

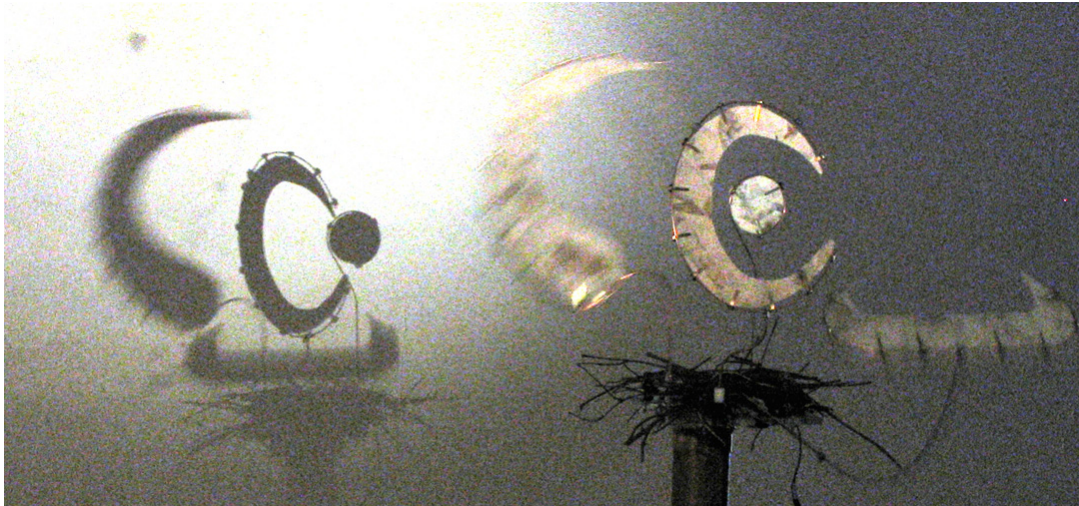


Figure 41: An autonomous shadow puppet. The machine is slowly relating a secret message to the viewer in its own shadow alphabet.

At the time, I was playing with idea of hidden communication. I have always been burdened by that idea of something trying to tell you something and your not being able to tell what it is or even that it is being communicated. There is that idea of the fly buzzing around you in a particularly persistent way being in fact a reincarnated or transmogrified relative or friend who through some trick of the universe is here with you now, desperately trying to get you to understand that it is them right up until the moment you squash them. There is the idea of extraterrestrial intelligence trying to tell us something in “person” or through waves through outer space and our not knowing what it is. Related, there is the other side of SETI (the Search for Extra-terrestrial Intelligence),

where we prepare our own messages hoping to code them in some way that would be obvious to any intelligence no matter its genealogy. There is the fact that animals all around us are signaling others in their own species and even other species in ways that are frequently invisible to us, especially if we neglect to look. As you might imagine, I am particularly interested in that last one. It's the "realest" yet almost most fantastical seeming given the general perspective of our society about animals. All animals have been so flatly grouped into the category of non-mental machines by the predominant bias, that the majority don't consider the possibility of animal minds and much of the others over-extend that possibility to far more of the animal kingdom than seems plausible.

So I made a machine, the *Stuttering Magpie Machine #1* (2006), that has a clear message and speaks in English but has the unfortunate handicap of speaking it letter by letter in an alphabet all its own, each letter equivalent to a Roman letter but rendered in shadows cast by the machine's four appendages.

Formally, I was thinking about D'Arcy Thompson, who points out that the structures we see in nature don't represent every imaginable possibility but only those that result from the inherent physics of structure and growth i.e. you don't see animals with horns that are shaped like Tinky-Winky's¹⁷, you see curves, spirals, dendritic patterns and the like. I was trying to make something with natural cues but with a Tinky-winky-like departure from the rules of pattern and form that nature holds to.

¹⁷ A character from an English-speaking television program for toddlers whose "horn" grows straight up from its crown, bifurcates, and then comes back together to form a perfect torus.

To understand the machine, a person had to first realize there is the possibility that something was being said and then go to much trouble to decode the message. To make decoding easier, I was providing a Rosetta Stone in the form of the “Counting Magpies” nursery rhyme written out in both Roman letters and Magpie letters. The message itself bid viewers to go to the smallest bridge in Schenley Park and look under it and to bring something shiny. If they went there they would find the machine’s nest.



Figure 42: Composite of photos of the shadow letters as cast by the Stuttering Magpie Machine, beginning with "A" in the upper left corner and reading left to right, top to bottom, alphabetically.

The last four symbols are a space, a period, a question mark, and an exclamation point.

An advisor was emphatic that no one would ever go through the whole process and find the nest. Suspecting he might have a point, I made the task easier by switching out the Rosetta Stone for a stack of little cards that laid out the Magpie letters beside their Roman equivalent. I had in any case envisioned the responses of the audience to the machine to be distributed like a wedding cake: the largest portion, the bottom portion of the cake, would be those who just looked at the machine and moved on in the style of art viewing, some, the next layer, might stop and inspect it long enough to realize the gist but then move on too, fewer still might spend some time to decode a single word perhaps just to verify that the machine was making words, a yet fewer still might translate the message, and perhaps fewer still would actually make the journey to the woods. My advisor thought this cake had one layer. I was optimistic it had at least three, especially after switching in the cheat-sheet cards, and saw the project as meaningful in any case. Surprisingly, for my advisor and for me by the time it happened, someone did decode the machine's message and go to the magpie machine's nest and leave it something shiny. And a note written in Magpie to come meet them at Kiva Han!

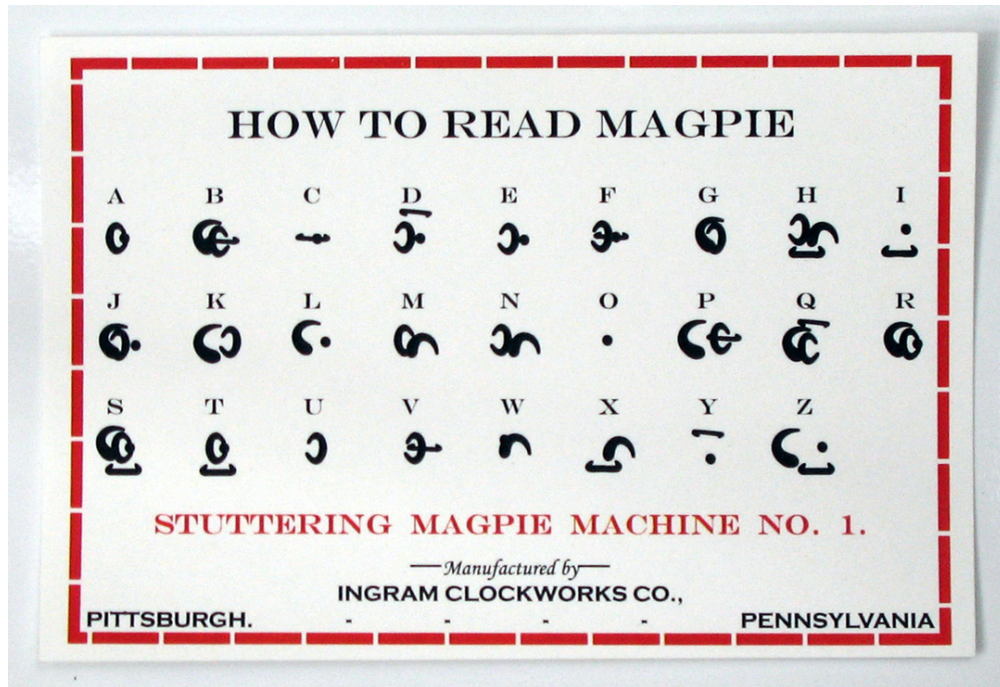


Figure 43: The card provided to aid deciphering of the Magpie alphabet.

In essence my advisor was right: a general audience can't be expected to invest as much as was required to go through my whole sequence. I knew that too but I think my imagined wedding cake was traditionally shaped whereas the real one had two significant layers, a tiny third layer and then an even tinier, needle-skinny layer that filled in for the last two. That last layer was just one guy, perhaps my core audience for that piece, who as it happened was a computer science major focusing in cryptography.

3.7: Birds Leap to Fly

I had been watching a lot of slow-motion video of birds in flight, including videos of birds taking off. I had a small personal epiphany while watching the latter that for the birds that can take off from a standing position (not all can) the first thing they do is make a mighty jump while beginning their first flap. That initial flap is pivotal, obviously, but

so is a big jump powered by strong legs. People have always dreamed of flying, literally while asleep and in their musings while awake, but all our bodies can do is leap. The body is both transport and cage. Humans tend to be content in their form and apparently most animals that might be thought of as having the mental capability for contentedness, also seem content but there are moments when we feel our cage and I think this is very strong when we wish to fly. It seemed that there was some poetry in comparing the human leap that fails to initiate flight and the bird leap that succeeds in initiating flight, the first reaching an apex and then finishing with a crash back to the ground, the latter continuing right up into the air.

Stated flatly, the piece I made, *Birds Leap to Fly* (2007) basically strayed a ways away from what I wanted. I had to make it in two weeks for a one night event and I mooshed experiments I was doing with other locomotion possibilities into it and the result was too cute, too traditionally interactive, and too much like puppetry. I made two legged puppets with bird feet and downy bodies hung from balloons since for the event I was going for a carnivalesque, celebratory look (it was for New Year's Eve). They were set up in a store front window. People outside could place their hands on hand-prints painted on the window to control the legs of the puppets. With a little practice, they could get them to hobble around and do jumps. As an interactive project that children and adults found delight in, it succeeded. But there is a lot of that these days and what I was going for was something that elicited a much greater sense of profundity in the participant.

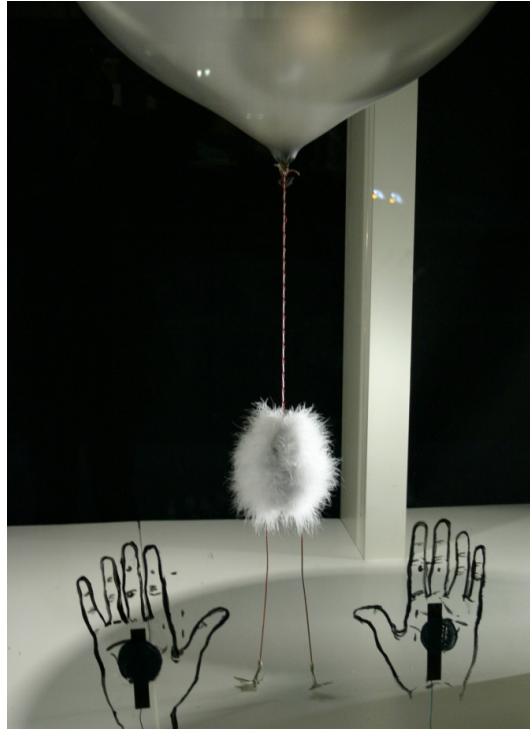


Figure 44: On Beyond Gosling, one of the two downy puppets that cavort in *Birds Leap To Fly*, in a window. Your hands control their feet.

For the thesis show, I decided to convert the piece slightly in an attempt to make something closer to what I was hoping for. The change I made was to place the balloon-borne baby-bird-machines in free space with the viewers and make two elevated platforms with active footprints instead of hand-prints so that to control the puppets people could use their feet, either one foot at a time, with both by jumping up and down on the platform, or by actually jumping off of the platform. In a slight way the project worked, some people reported that they actually felt transference to the puppet as it floated away when they themselves landed hard on the ground. But for me there remained too many issues with the piece, the cuteness broke the experience for me, it was

difficult to maintain because of issues with containing helium and it found its way too far outside my interests.



Figure 45: On Beyond Gosling jumps while On Beyond Eyas stands

Although the interface was simple and each machine had only two motors, there was a wide range of motions and gestures that could come out of them. Even under the rubric of leaps, a wide variety of types and heights could be achieved as the user practiced, and then there were numerous “special moves” like pirouettes and goose steps that you could get going. The lesson is that real world physics when given a ripe mechanism is a font of unexpected complexity. Simulation can generate complexity too but I think this is a different kind of complexity, if that makes any sense. Anecdotally, I remember reading an article about how one game company claimed to have perfected

their skateboarding physics engine declaring skateboard physics a solved problem. The fact is they linearized a bunch of non-linear systems to get output that looked right and allowed for most of the things they wanted to have in the game. The fact is the possibilities when real skateboards, bodies, and the asphalt are involved are a lot more wide-open.

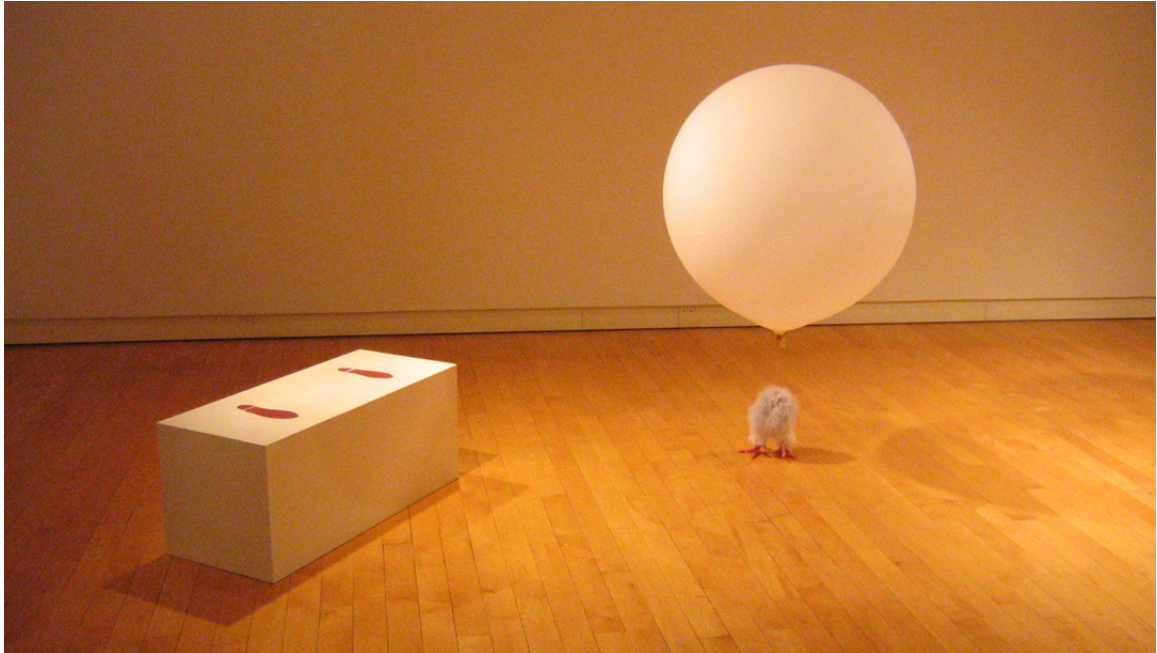


Figure 46: On Beyond Eyas awaits feet.

The happiest accident of the piece's tenure was the premature passing of one of the machines during the show's opening. I had weighted one of the machines a little light because I wanted to allow for big jumps in the vaulted gallery space. I was willing to let them even make jumps to the ceiling as I had bounced the balloons around up there to check for popping agents. A big jump did occur in the first 15 minutes, the machine found the sharp corner of a duct, there was a loud pop, and the machine crashed to the ground, pieces flying to every corner of the room. I had long become comfortable with

just letting my machines do their thing during an opening, even if that thing was breaking, so I let the machine lie twitching on the ground until it ceased. Undergraduate mourners gathered to kneel around it. The event was a stroke of good fortune for here in this instinctual human response, was indeed evidence of just the relationship between humans and the animate world, natural and artificial, that I hope to unveil. Here was an experience right in the midst of that knotty space of life, behavior, functioning, and death that humans navigate subconsciously in their interactions with each other, with other animals, and with this newer entity, the robot, which in its many forms pervades our modern world of animate objects. The narrative grew from the accident. There was an Icarus element for sure but more intensely there was the sense that something fragile and powerless that once had had the semblance of hopping gleefully around the room had perished. And like the baby birds the machine was loosely derived from, with their hollow bones and bodies shaped mostly by the fluff of feathers, the vivacity that gave it form and presence was lost in an instant, leaving a small lump of material that seemed too little to have ever been the thing it had been. The fallen machine with its popped balloon was just like that. And it was felt.

3.8: **Duck, Duck, Goose**

In making the majority of the projects I made in grad school, I hid or to some extent covered the mechanisms of the machine. *Schrecktier* had a case. The puppets of *Birds Leap to Fly* were wrapped in fuzzy feathers. The machinic elements of *Whole Other Kettle of Fish* were all concealed in a false ceiling. These weren't unintentional decisions. I have always been considerate of the choice to hide or not to hide. I was

actually actively fighting against an oft-encountered, almost hegemonic idea that mechanism should always be shown. To me, that idea curtailed many of the possibilities of the medium of automata. Not all kinetic, gestural, or behavioral works need to show what is providing their functioning, just as a bronze casting stands without the mould and a painting doesn't have a brush glued to it. I had been trying to juggle a balance of revealed and hidden. However, containing the mechanisms would often ruin the gracility I was hoping for and making.

With my next machine I wanted to play closer to the naked side. I wanted to take what had worked from the nakedness of *On Beyond Duckling* and push it towards a more fully considered and complete work that showed much of itself directly and invited inspection. I also wanted to further develop a number of ideas I had been working with over my time in grad school including the hybridization of artificial and natural materials, sometimes even using those natural materials functionally. In particular, I thought I would again use feathers but this time in an aerodynamic way more akin to their original purpose. I also wanted to use the natural parts gesturally and continue with the idea of secret signaling, in this case machine to machine, as opposed to machine to human or machine to animal. I didn't want to give up on story altogether but, as with *On Beyond Duckling* I wanted to have the narrative built through the action of the sculptures not to exist as a pre-formed story. I also wanted to rectify the wrong I had done to *On Beyond Duckling*, or at least avoid doing it again, by making this piece be a pair of machines instead of a lonely wanderer.



Figure 47: On Beyond Mother Goose on a small island in a lake.

I built the two machines On Beyond Mother Goose and On Beyond Father Gander¹⁸ which together comprise *Duck, Duck, Goose* (2007). As mentioned the “fragile” functionality of natural parts is re-purposed in the make-up of the pair of feathered robots. Duck pointer feathers here serve as the blades in the propellers that

¹⁸ In the vein of “Tales of the South” where all the animals are Bre’r this or Bre’r that (Bre’r Rabbit being the hero and Bre’r Fox the villain), I saw my “On Beyond” naming convention as linking a group of related machines.

allow the two machines to steer to different headings. Duck secondary feathers are used in the tail for signaling. Goose contour feathers are fashioned into a housing that keeps rain water off the machine's delicate electronics. An eggshell protects a tiny message hidden from view in that housing. However, the small DC motor that runs the propeller, the black-box hobby servos that move the tail mechanisms, the tail mechanisms themselves, the aluminum tubing and white plastic parts that connect everything structurally, and the wiring that connects everything electrically are all exposed sculptural elements. Importantly, the PCB that controls the machine and contains the electronic compass that gives the machine its migratory-bird-like sense of the Earth's magnetic field is tucked under the goose-feather carapace so that a curious viewer can look under and see it.



Figure 48: On Beyond Father Gander in a cow pasture.

In the piece, I attempted to meld mechanism to bird part in a way that was in places seamless and others jarring. Something about making a propeller out of feathers seemed to be both a beautiful idea and an affront to the non-machinic way in which feathers are used by a bird: spinning things to some end is such a common human solution.



Figure 49: On Beyond Mother Goose, with tail feathers splayed.

The two machines in *Duck, Duck, Goose* could be described as “gestural chimera” in addition to being structural chimera. Each movement exists on a continuum between the machinic and the animal. Each gesture inherits something from both, the propellers being the most like the artifacts of mankind but still wisping at the feather tips like birds taking flight, the tails having a sense of the spreading gesture of a bird’s tail while doing it with a mechanical motion and whirr. The motion of the goose feather cores of the machines as they do long spinning moves is perhaps the most like a complete facsimile of

a bird motion, seeming as it does like the shimmying of a water-fowl shedding droplets from its back

I think the piece poses a visual question: Are the feathers and the machine parts equal elements in a unified whole or are the machinic elements the core and the natural parts merely prosthetics making these robots the opposites of cyborgs?

4: Conclusions, Notes, and Future Work

4.1: Animal Aesthetics

That Doctor Doolittle was able to talk to animals is revealed as a hoax not as much by his lack of the body structures requisite to many modes of animal communication¹⁹, but that the kinds of things he said to animals, and they said back to him, had no relation to the usual kinds of things those animals find interest in. When animals talk to each other, they talk about what matters to them and, in fact, the vocabularies of their languages are limited to what is useful to their particular lifestyles.

So, when you talk to bees, it is no good to say “Please, would you mind not crawling up my nose?” because bees don’t talk to each other about crawling or noses and if they did talk about what smelling equipment they do have, they wouldn’t need to address the possibility of crawling into it because of the geometric impossibility: it just wouldn’t make any sense.

Doctor Doolittle could, however, if he were much smaller, had wings and the right smell, tell bees that they should fly at a forty-five degree angle to the sun for thirty yards to find some flowers that were just incredibly heavy with nectar. That’s the kind of thing bees talk about.

What does it take for an interaction between an animal and a robot to be meaningful to the animal? When ants communicate via pheromone trail something is transmitted but if this can be thought of as meaning at all it is a simple kind based on

¹⁹ For example, a phosphorescent bulb for conversing with fireflies or a color-changing skin to chat with cuttlefish.

instinctual pathways and nothing that could be thought of as comprehension. Complex meaning seems difficult to pass trans-species. For one, a given non-human species may not have the cognitive capacity for such meaning. Even if it does, what its complex cognitive functioning is attuned to may be very different than what a human's is.

Arguably, though, much of the game of life is the same for different animals and there are therefore overlaps in what animals from different species care about. Moreover, animals that are taxonomically close will share homologous cognitive origins and perhaps thus homologous cognitive functioning, if not in degree than in kind.

More and more aspects of human activity linked to cognitive functioning once thought unique to our species have been revealed to have strong analogues in other species. Chimps and birds use tools (chimps now even are known to hunt with weapons). Ravens and elephants can do arithmetic. African hunting dogs make coordinated plans before they hunt. Bonobos can understand language and even abstract syntax. Arguably, bower birds make "art." It seems likely to many that the quantity we call "mind" is possessed by animals other than ourselves, almost certainly not things like single-celled organisms, maybe not by fish and frogs, but very likely other great apes and perhaps by a number of other mammals, by some birds, and even some cephalopods. Which animals have mind, what brought mind to be (possibly independently on different branches of the tree of life), and whether mind is an unavoidable consequence of life as much as life may be an unavoidable consequence of the existence of the Universe are resulting questions.

And then there is a follow-on question: are aesthetics an unavoidable result of mind? Is positive sensation gained from doing a thing one way as opposed to another (in an artful way perhaps) a natural result of mind? Is pleasure gained from even executing

an action, or series of actions, not aligned with survival at all a natural result of mind? If we look at the aforementioned example of the bower bird, we might ask if the bower bird is really making art. We might determine (through adequate experimentation) that the bower bird's behavior has arisen through sexual selection over manifold generations in a habitat where selection via predation, resource-scarcity, and other harsh selectors has been negligible and that it is entirely instinctual. We may determine that sexual selection in a cushy habitat (which almost certainly played a role in the bower birds behavior) instead resulted in instinctual behavioral precursors that are tuned to react to the bird's environment to shape the behavior, perhaps even from direct learning from a parent, but that the bower bird has no "mind" so that even the learning plays out without awareness. Alternatively, we might determine that the same sexual selection in a cushy environment led to the behavior *and* a mind²⁰ and that the animal, and its viewer, the female bower bird, have a mindful awareness of the aesthetic qualities of what they are somewhat programmed to do in the way that human's treat and respond to the preparation and consumption of food.

So in which of the scenarios is the bird an aesthetic agent/recipient? Do aesthetics require mind, so only in the last scenario? Or do non-mindful animals also have aesthetic senses, so in every scenario to a different degree? Moreover, are aesthetics rooted more in non-adaptationist adaptations such as those that arise from sexual selection such as the bower birds' or are they rooted in the elegance of a well-adapted form, movement, or

²⁰ Really, it is not unreasonable to postulate that mind does arise from sexual selection and/or a cushy habitat.

behavior that later inheriting species manifest themselves in numerous ways including in non-adaptationist ones?

Growing out of the pieces discussed in this thesis, in my future work I hope to make a non-systematic assay of the aesthetic sensibilities of animals that I think may have them. I will try to make behavioral sculptures intended for these animals where the meaning conveyed is not informational but aesthetic, attuned to the animal's own aesthetic senses, possibly where these overlap our own so as to allow a deeper communion between myself, my human audience, and my animal one. The behavior of these embodied systems and of the natural fauna in response to them could perhaps be considered a new kind of ethological experiment.

4.2: Dangerous Play

Play is a vital behavior of almost all mammals and birds and some other species that have complex brains, like octopi. It seems to be a hallmark, if not a necessary part, of a higher cerebral functioning. Play and playful objects place human beings in a special mental space that is very accepting, vulnerable, and explorative. This state can serve as a portal to profound experience and communication. There is a playful aspect to most, if not all, of my projects and I think this functions as such a portal.

Our culture is seemingly more playful than any before it. Some describe this as a kind of Peter Pan effect, a stretching of the human focus on play and pretend out of childhood into adulthood. There is a related omnipresence of absurdity and surreality in our culture. One need only watch the cartoon network for a few minutes or look at a few billboards while driving down the highway to encounter the prominence, in fact near

dominance, of the surreal and absurd in contemporary culture. It is everywhere but somehow under the radar. We grow up with it in our Looney Tunes, Sponge Bob, or equivalent and the flow never stops: it's in the movies, it's in the literature, it's on the TV, it's in the TV commercials, it's in the toys, and it's in the products. And that is the thing: this seeming playfulness is mostly provided from above, it's top-down, it's structured and ordered before it gets into our hands or our kids'. The truth is there is much less true play. There is much less playful invention and exploration by today's kids and today's adults. In fact, perhaps all of this externally-provided play, pretend, absurdity, and surreality is not good for a culture and makes the populace *too* under the influence of the irrational, too unaware of where pretend ends and reality begins. Perhaps we, as a result less aware of the separation of play and not-play, are more malleable in the hands of the powerful who want us to believe things that are not true and who want to play with us as their own toys.

My projects already use a playful sensibility and allude to common absurdities to attempt to reveal where erroneous perspectives fall short, in my case especially as regards animals and the human place in nature, but in the future I hope to find even better ways to engage people's own playfulness in the use and observation of my objects and in doing so help in a re-awakening of the idea that play is definitely DIY.

4.3: Meaning Soup and Bombs

Work generates meaning through its interaction with the soup of ideas in the observers head. Ingredients in each mental soup vary but many in a given group (be it a species, a culture, a sub-culture) are likely to be the same. For someone's mind soup to

taste good to their inner chef, the ingredients must go well, so a good way to suggest a new ingredient is to package it with known ones: get people to start sipping your soup sample through familiar tropes mixed with enticing known-but-exotic ones and then have them taste the new idea. I think that this is in part why I have used things like nursery rhymes, children's stories, and animal parts: their familiarity is a good background for newfangledings.

I don't like to spell things out. I believe that carefully constructed ambiguity and re-interpretability is a cornerstone of good work. I have specific ideas behind my projects but I am really okay with people taking something else from it. This is not a misfire, it is bomb that lodges shrapnel in different parts of different people. I am trying to avoid making sniper rifles. However, the bombs are not of nails, nuts, and glass: all the shrapnel is of the same metal.

4.4: The Eggo and the Flid

Perhaps a key struggle behind my work is between a sense that we would all be better off if technological development hadn't been accelerating for the last couple of thousands years and a competing draw towards that development's output and potential. I am a plants and animals kind of guy who got funneled into a circuits and motors world when he was young and I am still trying to reconcile the resulting halves of myself - perhaps we could call them the eggo and the flid. The eggo draws me towards worms and squirrel tails as elements and the flid makes me think making a spacesuit for the former and computer-vision-based early alarm system for squirrels out of the latter is a good idea. It's actually not just my flid that thinks this. My eggo thinks that there is

potential for profundity, or at least potency, in what these kinds of projects can add to the mind soup of the contemporary observer who is trying to make sense of where unbridled technology has led our species in agriculture, medicine, war, finance and everywhere else and who is trying to figure out what we should actually be doing with ourselves and our makings.

4.5: Re-directing a legacy

The hands of human beings will be in the making of many future species of life.²¹ Whether those species are built of the same building blocks as the life the Earth has seen so far or from a different but analogous set of building blocks, we will have reached a point where sentient beings are designing other beings, possibly for the first time in the history of the Universe.²² It is likely that at some point we will be able to give these beings “cognitive” functioning similar to our own. This will be the first time in the history of this planet, perhaps of this Universe, that a made object will be able to reflect on its origins. Unlike ourselves, these beings will likely have the full history of these origins readily available to them²³, whereas we have had to tease the mysteries of our origins out from evidence left in our habitat and in our bodies. Regardless of whether

²¹ Assuming one is willing to call related groups of anthropogenic life-forms “species.”

²² If life turns out to be more common in the Universe than some assume then intelligent life probably is also and hence probably there will have been other instances where evolved intelligent life began to make non-evolved life.

²³ Although the ontological mysteries concerning the Universe's predisposition towards allowing the existence of thinking beings might remain.

these beings supplant us or live along side us, a legacy of our species will be present in them²⁴.

In our present society, the most fervent efforts to create intelligent machines are made by the military-industrial complex. If this pattern continues, then the legacy of humankind will be of conflict and violence and the beings' origins mired in these aspects of ourselves. My hope is that our species will find ways to re-direct our attentions away from violence and that, in turn, the process of development that will lead to manmade sentient beings will move into a different aspect of the human being and hence that future such beings will have a happier origin to reflect upon. If they are born as playful things, or even as artful things, that will be our legacy and that will be what of humanness we pass on.

²⁴ As is pointed out by the philosopher, Jean-François Lyotard, in his essay "Can Thought Go On Without a Body."

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6: Appendix I

Do electric sheep have a dream that one day little electric lambs will be able to join hooves with little organic lambs as sisters and brothers?