

The Rise of the Mechanical:
How Authors of Scientific Romances Imagined Future Vehicles

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Abstract

Whereas many have surmised that the technological vision for biorobotics originated with science fiction, it actually originated much earlier, in a constellation of science-influenced works of fiction in the romance tradition little-known as the “scientific romance.” The scientific romance has been suppressed by science fiction scholarship, and this suppression has occluded science fiction’s own connection with a history of imperial politics, including imperialism’s appropriation of scientific inquiry for its own ends. As nineteenth-century scientists sought to legitimate their research in terms of imperial priorities, anatomists and physiologists lent their discoveries to the technological development of vehicles that would reshape society economically and militarily. These vehicles, patterned after the bodies of nonhuman animals and designed to replicate their locomotion, are “mechanimals.” Samuel Butler elided the difference between animal and machine by imagining mechanical development in evolutionary terms, which also portrayed machines as extensions of the self in space. He saw the technological ingenuity required to develop such machines as essentially British, and argued that this is why the British Empire would outrun its European competitors. Jules Verne designed the mechanimal body by refining the designs of the vessels the Royal Navy used in polar exploration, ultimately imagining a cetacean submarine that solved the problems and surmounted the obstacles faced by surface ships. His machines’ effectiveness, predicated on their biomimicry, imbued the biomimetic with an aura of futurism. Tom Greer drew attention to the fact that, when he was writing in 1885, Ireland was scientifically more advanced than England, and imagined the Irish Rising that would occur should a scientifically-educated Irishman develop a flying-machine before the English did. In contrast with the wonder Verne’s machines inspired, Greer incited terror, particularly at the notion that a flying-machine would bypass the English

Channel and the Irish Sea, making England more susceptible to invasion than ever. H. G. Wells commingled wonder and terror in *The War in the Air*, which reads as a propagandistic attempt to get the Americans to develop mechanical vehicles since England, Wells's own country, was technologically lagging. This was one part of Wells's *oeuvre*, which he used to influence the modern future throughout the world.

This dissertation is dedicated to
my beloved parents,
Loren and Brenda,
and
to my best friend and partner in life,
Dr. Addie E. Long.

I have loved this work because you have loved me so well.

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In *Twenty Thousand Leagues Under the Seas*, Captain Nemo intimates to his passenger, Dr. Aronnax, that the *Nautilus*, Nemo's ship, has been assembled out of parts manufactured across the globe; in at least that way, this dissertation is like the *Nautilus*. The parts that have been assembled into this whole (miraculously, it sails!) have come from across the globe, and thanks are due to all who were involved.

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Aaron M. Long

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Table of Contents

List of Illustrations	xiv
Introduction: The Romance Tradition and the Mechanimal Wonder	1
Chapter I: The Butlerian Synthesis: Mechanicity, Evolution, and Imperialism	39
Chapter II: Jules Verne: Designer of the Mechanimal Body	69
Chapter III: Mechanimal Knowledge and the Mechanimal Terror in Tom Greer's <i>A Modern Daedalus</i>	122
Chapter IV: Mechanimal Vehicles and H. G. Wells's Future World State	164
Epilogue: Tracing (or Mapping) the Mechanimal Rising	213

List of Illustrations

Figure 1: The aeronef as d'Amecourt imagined it	72
Figure 2: Verne's aeronef <i>Albatross</i> as depicted in <i>Robur-le-conquérant</i>	73
Figure 3: Cayley's propeller prototype	74
Figure 4: A photo Nadar made of one of his, Landelle's, and d'Amecourt's propeller prototypes	88
Figure 5: Pettigrew's drawing of a fish's helicoidal locomotion	90
Figure 6: The <i>Victory</i> , newly refitted, leaving port on Ross's 1835 expedition	96
Figure 7: Riou's depiction of Nemo's <i>Nautilus</i> 's metal interior	99
Figure 8: German airships looming through the murk of a burning New York City	177
Figure 9: Two American flying-machines attack a cetacean German airship	185
Figure 10: A German airship downed by an insectine swarm of biomorphic Asiatic fighter craft	186
Figure 11: A reprint of Kaiser Wilhelm's <i>Völker Europas, wahrt eure heiligsten Güter!</i> (<i>Peoples of Europe, Keep Your Holiest Goods!</i>) in <i>Harper's Weekly</i> (1898)	192

Introduction: The Romance Tradition and the Mechanimal Wonder

Many things that science has rendered common often approach sublimity.

William Wilson, *A Little Earnest Book upon a Great Old Subject* (1851)¹

Markus Fischer, Project Manager for Festo AG & Company's SmartBird, presented a working prototype at TEDGlobal 2011, stunning the audience with a machine that flew, not like the quadcopter designs that have become common since then, but by flapping—like a bird. Festo's pamphlet on the SmartBird indicates that "The objective of the project was to construct a bionic bird modelled on the herring gull" and called the result "an artificial bird."² Later that year *Wired* published an article that declared, "If Air Force researchers have their way, the military's next flying robots of doom will be tiny, and indistinguishable from the naked eye from small birds, bats or even insects,"³ chronicling research from the Micro-Aviary, a mini-drone test site at Wright-Patterson Air Force Base, near Dayton, Ohio. Researchers at the Micro-Aviary have been developing ornithopters (bird-flapping robots) and the sensors it takes to identify and locate them. A 2012 follow-up article in *Wired* indicated that the Army had allocated budget for research on *applying* the same or similar technology.⁴ 2013 was a banner year for a conversation about drone algorithms, with Raffael D'Andrea's TED Talk demonstrating the abilities of an

¹ This phrase is taken from Chapter X, the section of Wilson's book in which appeared what is now believed to be the first written instance of the term "science fiction."

² "SmartBird," Festo AG & Company, April 2011, accessed 25 October 2018, https://www.festo.com/net/SupportPortal/Files/46270/Festo_SmartBird_en.pdf.

³ Spencer Ackerman, "Air Force Keeps 'Micro-Aviary' of Tiny, Bird-Like 'Bots,'" *Wired* 2 November 2011. Accessed 24 October 2017. <https://www.wired.com/2011/11/air-force-micro-aviary-drones/>.

⁴ Katie Drummond, "Army Wants Flapping Wings to Fly Drones of the Future," *Wired* 30 March 2012. Accessed 24 October 2017. <https://www.wired.com/2012/03/army-wings/>.

algorithmically coordinated trio of quadcopters.⁵ D’Andrea, whose research has been funded by the Defense Advanced Research Projects Agency (DARPA) for several years, referred to this coordination as “machine athleticism.” Also in 2013, Google, perhaps the largest corporation involved in developing artificial intelligence, acquired Boston Dynamics, then a barely-twenty-year-old company, which specializes in building robotic devices based on biological bodies, including dogs, cats, bulls, and insects, focusing its developments on replicating nonhuman animal locomotion in machines for industrial and military applications. In May 2018 Boston Dynamics unexpectedly announced that one of its canine robot models, the Spot Mini, would go on sale to the general public the following year. Six months later, Naval Group, a French defense contractor, released the design of the SMX31, an electric submarine designed after the sperm whale to improve its stealth and sensory capabilities.⁶ Improved stealthiness expands the SMX31’s payload beyond the now-standard array of torpedoes and missiles on most submarines to include a fleet of unmanned aerial vehicles (UAVs) capable of performing a variety of intelligence and military tasks above the surface of the water, even while the SMX31 remains submerged.

This bevy of new technologies emerged amid nearly a decade of news coverage of the United States federal government’s increasing deployment of UAVs, popularized as “drones,” which frequently kill civilian bystanders; the actual death toll is notoriously difficult to confirm. Amid an international outcry over drone strikes, myriad questions have been raised about the ethical implications of biomorphic robotic bodies moving through our world according to the

⁵ Raffaello D’Andrea, “The astounding athletic power of quadcopters,” *TEDGlobal* June 2013. Accessed 24 October 2017. https://www.ted.com/talks/raffaello_d_andrea_the_astounding_athletic_power_of_quadcopters.

⁶ Kyle Mizokami, “The Sub of the Future Is a Drone Mothership Inspired by a Sperm Whale,” *Popular Mechanics*, 3 November 2018, accessed 6 November 2018, <https://www.popularmechanics.com/military/navy-ships/a24523409/new-submarine-concept-vehicle-smx-31/>.

criteria of some artificial intelligence algorithm or under remote control by unseen, unreachable human operators.

When the wrong person is targeted, or an innocent bystander is killed, imagine the sense of impotence and rage. How do those who remain strike back? No army is arrayed against them, no airfield is nearby to be attacked. If they manage to shoot down a drone, what have they done but disable a small machine? No matter how justified a strike seems to us, no matter how carefully weighed and skillfully applied, to those on the receiving end it is profoundly arrogant, the act of an enemy so distant and superior that he is untouchable... Is it any wonder that the enemy seizes upon targets of opportunity—a crowded café, a passenger jet, the finish line of a marathon?⁷

In light of such questions, the technologies mentioned above introduce to this already dire geopolitical situation the crisis of yet one more level of concealment: now the machines which so many worldwide have felt powerless to stop will be concealed in bodies that resemble familiar species, the nonhumans with which we cohabit, our biological neighbors. One recent example is an avian surveillance drone that *Popular Science* attributed to Somalia's National Intelligence and Security Agency after it crashed in Mogadishu in 2016.⁸

Since they have made the news, the Mogadishu bird and the other machines mentioned here are presumably among the most awe-inspiring episodes of the “Biomimicry Revolution” that Janine Benyus heralded in 1997.⁹ Since the awe they inspire is just as often terror as it is wonder, the problem of their existence has been compounded by their sudden emergence in public discourse after 9/11, in a variety of fora: they appeared in TED Talks, in technology journalism, and in film and television—media that emphasize the wonder and downplay the

⁷ Mark Bowden, “The Killing Machines: How to Think About Drones,” *The Atlantic* September 2013. Accessed 4 January 2020. <https://www.theatlantic.com/magazine/archive/2013/09/the-killing-machines-how-to-think-about-drones/309434/>.

⁸ Kelsey D. Atherton, “Small Bird-Shaped Drone Crashes in Mogadishu,” *Popular Science* 14 July 2016. Accessed 24 October 2017. <https://www.popsci.com/small-bird-shaped-drone-crashes-in-mogadishu#page-2>.

⁹ Janine M. Benyus, *Biomimicry: Innovation Inspired by Nature* ((San Francisco, CA: HarperCollins, 1997), 2.

terror of such machines. As the smartphone reinvigorated the demand to see ourselves and one another on camera, camera drones like the Parrot AR led a wave of civilian-generated aerial photography that has since become commonplace in commercial advertisements, real estate listings, and sports. We have bought into the wonder that sold us this technological vision, and it is becoming so normal to us that we will soon pass beyond the point where it would occur to us to rethink our governments' uses of them, either in strikes on foreign soil or in policing on our own. While we remain dazzled by a Silicon Valley sales pitch, the world is being populated by animal-like machines designed to surveil and destroy.

Describing the Animal Redesign Project

Part of the problem is that we still do not know how to talk about machines that represent efforts to redesign animal bodies or body parts; and without a helpfully specific vocabulary we find ourselves without a way to trace the histories of such machines, without a way to tell the story of how they came to be in the world: we lack a *mythos* of the animalized machine. Without such a *mythos* we fall prey to small-scale stories about specific machines, which are often spun by advertisers and TED Talkers, propagandists-for-hire who have been tasked with capturing our techno-religious fervor, our brand loyalty, our political allegiance, and our hard-earned cash. But one way to dispel awe—whether wonder or terror—is to introduce historical explanation; and for that, we need the right words.

At one point the Federal Aviation Administration was insisting on a narrow definition for the noun “drone” and objecting to its use in describing the Predators and Reapers commonly implicated in “drone strikes.”¹⁰ These machines are officially labeled “UASs”—“unmanned

¹⁰ At one point, the FAA was insisting that people refer to them as “unmanned aerial systems,” or “UASs.” See Nidhi Subbaraman, “Don’t call ‘em drones: The wide world of unmanned flying machines,” *NBC News* 15

aerial systems”—but even “UAS” can describe anything from a remote-controlled flying toy to a war machine larger than a Cessna. In any case, the fact that we are still referring to Reapers and Predators as “drones” speaks to a general lack any better vocabulary to say what we mean; and as the number of human-made machines mimicking nonhuman animals increases, the catch-all “drones” will become even less precise. Colin Salter has used the nouns “biorobots” and “biorobotics,” which, although useful, elide a great deal of these devices’ technological, scientific, and cultural histories. Despina Kakoudaki has noted that the English word “robot,” from the Czech word *robota*—“worker”—found its way into general use through Karel Čapek’s 1920 play *Rossum’s Universal Robots*.¹¹ Read with this history in mind, “biorobot” conjures interesting images, but does not specifically denote machines patterned after nonhuman animals. Moreover, the vision of replicating nonhuman bodies in mechanical apparatuses predates Čapek by at least a half-century. Following Donna Haraway, some might call these machines “cyborgs,” a portmanteau formed from the abbreviations of “cyber” and “organism”; but there is nothing materially organic about many of them—their organicism is often restricted to their forms and functions—so the “org” in “cyborg” seems misapplied. Neither are they “posthumans” because even though humans designed them, they are neither humanoid (human-like) nor android (man-like).

Existing adjectives are equally imprecise. The machines mentioned above are “biomorphic,” but that term originated in late-nineteenth-century anthropology to describe much simpler human-made artifacts, such as carvings and pottery, that resembled any biological form,

March 2013. Accessed 27 November 2019. See <https://www.nbcnews.com/tech/innovation/dont-call-em-drones-wide-world-unmanned-flying-machines-f1C8857699>.

¹¹ Despina Kakoudaki, *Anatomy of a Robot: Literature, Film, and the Cultural Work of Artificial People* (New Brunswick, NJ: Rutgers University Press, 2015), 9.

including plants. Since my concern here is with nonhuman animals and not with plants, “biomorphic” is too general to be useful because both “bio” and “morph” are too open to interpretation. One might also say these machines are “bioinspired,” but this term is vague, connoting a less-fully-realized biomimicry that guesses at what inspired their designers. “Biomimetic,” the adjective form of the term “biomimicry” popularized by Benyus, does a better job of clarifying the relationship between a natural nonhuman body and a human-made mechanical body that resembles it, but as with “biomorphism,” “bio” does not clearly specify animals.

At the very least, we need a noun that evinces the design continuity between biorobots—drones, for example—and their vehicular predecessors—in the Predator’s case, the larger but similarly-shaped Boeing 747. Both recent scholarship and a moment of reflection reveal that during the twentieth century vehicles were often animalized, described using terms previously used to describe animal bodies. As Nicole Shukin has observed, the mobility of modern capitalist societies is predicated on the mimetic relationship between the animal body—which is “animal” because animated, self-moving—and the machine, which more purposively labors to human ends.¹² As such, even modern automobiles, which do not particularly resemble any nonhuman animal species, were frequently animalized as, for examples, the Ford Mustang, Mercury Cougar, Buick Wildcat, Dodge Ram, and Chevrolet Impala. A term that could maintain the continuity between biorobots and modern vehicles would evoke a longer arc of history that stretches between premodern biomorphic artifacts, which were ultimately inspired by animal bodies, and the ersatz animals of our robotically accomplished twenty-first century.

¹² Shukin, 89.

Grammatically, we could use a term that can do the work of both a noun and an adjective, that preserves a sense of the design continuity between robots and the human-piloted vehicles that they are beginning to replace, and between these human-made machines and the bodies of biological nonhumans that they mimic, replicate, or imitate. I propose the term “mechanimal”: our world is being populated by mechanimals—both mechanimal robots and mechanimal vehicles—and our bodies are being augmented by mechanimal prostheses. Note that the term functions as both noun and adjective. As an adjective, it describes both vehicles and robots, but could also be used to talk about exoskeletons or prostheses without unduly complicating the vocabulary by accounting for the human body’s spatial and interfacial relationships with them while they’re operating, something our current vocabulary seems obsessed with, as seen in “unmanned aerial system.” In light of the concerns I raise here, the anthropocentric concern about whether our bodies “wear,” “drive,” or “remotely control” one of these machines is of secondary importance. The adjective “mechanimal” also denotes these devices’ mechanicity while alluding to both their human-made-ness and the fact that they partly or entirely resemble nonhuman animal bodies. It also avoids foreclosing design-related questions, for example, questions about whether a machine fully replicates a nonhuman animal’s form and movement (“biomimesis”) or merely appropriates some of its biological structures and their functions into a larger mechanical design (“bioinspiration,” “biomorphism”).

There is also a performative aspect to “mechanimal.” Within the environment of the text it appears familiar, commonplace; it is easily mistaken for the known word “mechanical.” Like the machines it is being used here to describe, it seeks to pass as ‘natural,’ and sometimes it does pass. But sometimes its camouflage malfunctions and we recognize that it is not quite what it initially appeared to be. It is therefore a term from a time—our time—when human attempts to

replicate nonhuman lifeforms are viable but not perfect, a time in which mechanical bodies may superficially resemble nonhuman animal bodies, though the resemblance breaks down under close scrutiny.

Since it is partly derived from the root word “animal,” “mechanimal” preserves the troubled history of humankind’s relations with nonhumans, including the ways the word “animal” has elided, for humans, the differences between nonhuman species and objectified them to authorize or rationalize human violence against nonhuman bodies. For this reason, some might construe my choice of “mechanimal” as anthropocentric; I abjure the charge. If anything, my motives are biocentric. One might call them “life-ist,” where “life” refers to the organisms that coevolved with humankind, not to some sort of mechanically animated life-likeness that humans conjured in an attempt to replicate organisms we still do not fully understand. Calling these machines “mechanimals” preserves a sense of the link between scientists’ violations of animal bodies and political violence: as C. S. Lewis pointed out, “what we call Man’s power over Nature turns out to be a power exercised by some men over other men with Nature as its instrument.”¹³

Moreover, I would suggest to any reader who objects to objectification that it is arguably morally permissible to objectify mechanical bodies. The term “mechanimal” objectifies; but the class of bodies it objectifies are often instruments of power. Those who describe such instruments as mechanimals deploy the term in resistance to the power that mechanimals embody. Used this way, “mechanimal” does not objectify living nonhumans nor human others, only life-like replicas of biological nonhumans that were designed and deployed by humans to serve human purposes that their biomorphic shapes help to obfuscate. Objectification—the act

¹³ C. S. Lewis, *The Abolition of Man* (San Francisco, CA: HarperSanFrancisco, 2001), 55.

of saying “That is a mechanimal”—singles out specific bodies for interrogation. And where a mechanimal has been deployed to enact power over people, objectification of the device is a crucial step in liberation that helps people identify, classify, and understand the machines moving through our shared environment.

From all of this it is apparent that both the machines designed after nonhuman animal bodies and the rhetoric we use to describe them are political. In offering a *mythos* of the animalized machine, here I trace the political and cultural forces that have shaped mechanimals, the vision for which first emerged in literature. Although, as I have mentioned above, one might trace mechanimals at least as far back as the Trojan Horse, here I trace them to the dawn of modernity, i.e. to nineteenth-century Europe, particularly Britain. When mechanimals are understood as human designs, produced by human labor, and deployed by some humans with specific purposes that affect other humans who are sometimes not only distant in space but also in time, our responses to them—to both individual mechanimals and to the presence of a kind of machine that could be described as “mechanimal”—are less intuitive, informed more by the politics of their histories and designs. The goal of mapping these forces is to avoid both the gut-level, Luddite impulse to destroy what humans have made, and what I envision as a coming transanimalist drive to treat as equal the devices humans have made and the nonhuman species with which they cohabit.

Biorobotics: The Stuff of Science Fiction(?)

A *mythos* of the animalized machine must account for three discourses about them. First, among these are discourses on bodily design, which inform the historical context for this dissertation and reveal that biorobots are modern iterations of biomorphic artifacts. A second discourse that has to be accounted for is science-influenced literature, since, especially in recent tech

journalism, biorobots are frequently thought of as the realization of science fiction, as science-fiction-made-real. The incorrigibility of this recognition in late-twentieth- and twenty-first-century writing about technology offers a valuable clue about where in history to begin looking for the emergence of the modern mechanical. Third—and this is a product of a variety of factors, including the first two mentioned here—like some older biomorphic wonders, biorobots inspire wonder and sometimes terror. During the Renaissance, wonder was often afforded¹⁴ by biomorphic objects, which came to be known as “wonders.” These three discourses intersected in the nineteenth century, particularly in scientific romances, whose writers imagined ever-more-sophisticated versions of wonders. Over time, this imaginative work was instrumental in turning Old World wonders into a vision for modern mechanical vehicles. In the late-nineteenth and early-twentieth centuries these vehicles inspired both wonder and terror because they afforded their human operators means of surveillance and violent attack. As the twenty-first century has proved, even vehicles not designed to afford violent attack can be used violently; and so, vehicles, when new, evoked wonder, and when deployed violently, inspired terror. And wonder and terror are always political.

Nineteenth-century discourses on bodily design are difficult to study for the same reason that we have no *mythos* of animalized machine: nineteenth-century thinkers also lacked vocabulary to describe the design vision of an animal-like machine. The term “biomimicry” did not emerge until the mid-twentieth century. Since its emergence it has become clear that to say that biorobots were designed using biomimicry is to note their relationship to a way of thinking about the nonhuman that was mutually constitutive with empire, a scientific application of

¹⁴ Here I am using the term “afforded” in the sense used by Tim Dant: “An object does not have affordance as a general property (such as its weight or chemical composition) but affords particular things to the materiality of particular species. An armchair affords a bed to my cat but affords a seat to me.” Dant attributes the term to James Gibson, for which see Tim Dant, “The Driver-Car,” *Theory, Culture & Society* 21:4/5 (2004): 61-79.

imperialism's reach for total administrative control. In the earliest use of the term in chemistry, "biomimicry" denoted an inorganic chemical reaction that replicated reactivity already seen in organic chemistry.¹⁵ But within a decade the term appeared in engineering, in Julian F. V.

Vincent's *Structural Biomaterials*:

If skin, tendon, hoof, horn, bone and nacre are such wonderful pieces of materials engineering, why don't we try to make them ourselves, or at least use some of the ideas contained within them to our [humans'?] own advantage? As our understanding of materials in general, and biological materials in particular, has been advancing, so has our ability for biomimicry. But the ability to do something has to be driven by desire or necessity. Why should engineers be interested in biological materials? One only has to look to the history of technology, starting from the first use of tools, to see that revolution and progress are driven by the new possibilities which new materials create. The initial and most obvious effects are frequently expressed as advances in the technology of weapons. So bronze yields to iron which in turn yields to steel.¹⁶

Vincent's use of *biomimicry* here explicates the anthropocentrism that was only implicit in the materials chemistry research behind the term's original usage. Vincent is a human talking to humans about what human researchers and developers might make, based on their newfound ability to make materials that mimic biological materials. Moreover, the sources of the biological materials to which he refers are nonhuman animals, living organisms. As such, he tends to see nonhuman bodies as, essentially, useful material. It is still more troubling that the first application he envisions for biomimicry is military.

Since then, Janine Benyus popularized the term "biomimicry" and theorized it as part of a larger, more ecologically-friendly value system, a move that underscores the growing

¹⁵ Connie Lange Merrill, *Biomimicry of the Dioxygen Active Site in the Copper Proteins Hemocyanin and Cytochrome Oxidase: Part I: Copper(I) Complexes Which React Reversibly with Dioxygen and Serve to Mimic the Active Site Function of Hemocyanin. Part II: Mu-Imidazolato Binuclear Metalloporphyrin Complexes of Iron and Copper as Models for the Active Site Structure in Cytochrome Oxidase* (Houston, TX: Rice University Press, 1982). This is Merrill's dissertation. It offers no clear definition of "biomimicry," but implies that inorganic reactions mimic organic reactions.

¹⁶ Julian F. V. Vincent, *Structural Biomaterials* (Princeton, NJ: Princeton University Press, 1990), 204.

recognition that biomorphism affords concealment. According to Benyus's *Biomimicry: Innovation Inspired by Nature* (1997), "Biomimicry is a new science that studies nature's models and then imitates or takes inspiration from these designs and processes to solve human problems"; "Biomimicry uses an ecological standard to judge the 'rightness' of our innovations"; and "Biomimicry is a new way of viewing and valuing nature [that] introduces an era based not on what we can *extract* from the natural world, but on what we can *learn* from it."¹⁷ While Benyus's high ideals are admirable, the cracks in them are visible. Her first tenet implicitly authorizes humans' appropriation of any nonhuman design for human use. The second tenet is open to a variety of philosophical critiques. What makes us think that ecological standards are self-evident enough to be useful in judging human innovations? Aren't all scientific findings open to interpretation by humans? To the extent that they are, doesn't that mean that in any conversation about some set of standards we discover in nature there will be human agendas that color whatever ethical precepts are derived from the evidence? Moreover, don't the scare quotes Benyus places around the word "rightness" already suggest her own cynicism toward the normativity of any set of precepts? Doesn't such cynicism from one who propounds this ethical methodology suggest that it is just another tool by which some with the relevant expertise will seek to wield power over others who lack it? Her third tenet invites the question of the difference between "extracting" something and "learning from" it, which, amid Benyus's ethical cynicism in the second tenet, reads as a euphemism. Wouldn't we say that the anatomists and physiologists who carried out the Linnaean Project in the late-eighteenth and early-nineteenth centuries "learned from" the specimens they studied—by extracting them from their natural

¹⁷ Benyus, *Biomimicry*. See the book's frontispiece, which has no page number, for this quote. Emphasis here is Benyus's.

habitats and extracting their organs from their bodies? Benyus's biomimicry also seems suspect because the term has long been used in much more violent ways and hers was the first attempt to rectify this usage. Vincent's usage raises questions about whether Benyus's use of the term was a green-washing, a work to occlude the fact that a defense development agenda was driving the design theory she popularized.

Although that military agenda predated the 9/11 attacks, they affected the political historical context of its unveiling. In the years following the attacks the War on Terror became known as the Drone Wars, a series of interventions in which American and other Western military forces were accompanied by remotely- and algorithmically-controlled vehicles. Such vehicles are frequently described in biological terms, the most famous of which is the word "drone," an entomological term used to describe the worker-class organisms from species within genus *hymenoptera* (e.g., ants, bees, and wasps, among others). Colin Salter has traced the implications of the anthropocentrism intrinsic to biorobotics research, one of which is the value of human soldiers' lives above those of weaponized nonhuman animals.¹⁸ Salter has identified the weaponization of nonhuman animals as one of the Defense Advanced Research Projects Agency's (DARPA's) highest priorities, citing a 2002 speech by Donald Rumsfeld, then Secretary of Defense, who argued that

We must promote a more entrepreneurial approach to developing military capabilities, one that encourages people, all people, to be proactive and not reactive, to behave somewhat less like bureaucrats and more like venture capitalists; one that does not wait for threats to emerge and be "validated," but rather anticipates them before they emerge and develops new capabilities that can dissuade and deter those threats.¹⁹

¹⁸ Colin Salter, "Animals and War: Anthropocentrism and Technoscience," *Nanoethics* 9 (2015): 11-21.

¹⁹ Quoted in Salter, 14-15.

In this speech Rumsfeld was implicitly redefining the old phrase “total war,” so that it included not only the human population of the United States and all of its economic resources, but also extended that definition to include the nonhuman population of the United States and all of its natural resources as well.

But the lifecycles of biological objects are less controllable than the lifecycles of mechanical objects. It takes time to breed insects, but human-made devices can be constructed quickly, given enough funding and labor. Moreover, why jeopardize life—even animal life—if it can simply be replicated in machines built from synthetic materials? To the extent that it makes possible this replication, the biorobotics research that has been featured in TED Talks in the years since Rumsfeld’s speech embodies Benyus’s social vision for biomimicry by imitating nature’s models and appealing to a natural standard for building and deploying weapons. Such research also exemplifies and publicizes the kind of innovation that Rumsfeld was advocating, tinging it with wonder and broadcasting it to the rest of the world so that America’s enemies see the technological prowess they would have to confront if they were to carry out acts of aggression against the U.S. In this way, biomimicry has become an organ of counterterrorism propaganda that flaunts the United States’ futuristic military technologies.

That Benyus sees in biomimicry the potential for a humanist utopia and Salter the potential for a pan-biological dystopia explains, to some extent, the incorrigibility of the association of biorobotic machines with science fiction. Francis Fukuyama’s monolithic book, *Our Posthuman Future* (2002), begins with a chapter called “A Tale of Two Dystopias” which traces the biopolitical issues surrounding biotechnological development back to the visions cast by Aldous Huxley in *Brave New World* and George Orwell in *1984*. In fact, this dissertation was

born when a science fiction reference was inserted into a public policy conversation on the United States Armed Forces' use of drones.

During the spring of 2014 I attended a panel on drones, part of the Innovations Series hosted by the Dole Institute for Politics at the University of Kansas. Special guests that evening were Admiral Timothy Beard, U.S. Navy (retired), and Scott Winship, Vice President of Advanced Air Warfare Development for Northrop Grumman. During the question-and-answer period another attendee posed a question about the ethics of killing people from a distance using drones in which he cited the assassination of Anwar al-Awlaki, the first American citizen to be killed by a drone strike ordered by the President, and expressed fear that the automation of drone strikes would realize Skynet, the artificial intelligence that powers cyborg soldiers and war vehicles in the fictitious world described in the *Terminator* films. I took the opportunity to ask Beard and Winship whether there was fiction or film that had personally influenced either of them as they thought about their work in drone development. In his answer, Winship intimated that he “love[s] science fiction a lot” and that he reads constantly, alternating fiction and nonfiction; one influence he cited was Orwell’s *1984*.²⁰ When asked, those engaged in developing biomorphic robots for military purposes associated their work with science fiction, even if they initially struggled to name a particular author or work of literature that influenced their research. I left that evening convinced that this dissertation would have to clarify the literary history behind the intuition that there is a connection between biorobotic devices and science fiction, because the stories included in that history are influencing public discourse on biorobotic machines, even when people cannot readily identify which stories are influential.

²⁰ Dole Institute of Politics, “Innovations Series DRONES – Part 1 Unmanned Drones: Soldiers without Uniforms,” *YouTube*, 6 March 2014, <https://youtu.be/x8o65FjIQ0k?t=51m25s>. See 51:25 to 56:35.

It is also worth noting that, in twenty-first-century tech journalism, it is common to associate emerging biomimetic technologies with science fiction is commonplace. One report on Boston Dynamics's robots claims that "the latest demonstrations... really could be clips from science fiction flicks we grew up with."²¹ This association appears even in the columns of august news outlets such as the *New York Times*, which has reported that the Pentagon "is spending billions of dollars to develop what it calls autonomous and semiautonomous weapons and to build an arsenal stocked with the kind of weaponry that until now has existed only in Hollywood movies and science fiction, raising alarm among scientists and activists concerned by the implications of a robot arms race."²² A report from the *Washington Post* has observed that the consequences of robotic warriors and police "could be very much like we've seen in dystopian science fiction."²³

Fukuyama's "A Tale of Two Dystopias" oversimplified the biopolitics of biotechnology and steered bioethical discourse away from biomimetic devices manufactured from non-biological materials because he overlooked another influential dystopia: Ray Bradbury's *Fahrenheit 451*. Since the 9/11 attacks, science fiction film and television have increasingly depicted biomorphic machines like Bradbury's mechanical hounds. For example, Michael Bay's *Transformers* franchise featured robots shaped like, alternately, vehicles and biological creatures,

²¹ Eric Mack. "Boston Dynamics' Robots Can't Catch You Just Yet, But They're Gaining Fast," *Forbes* (11 May 2018): n.p. See <https://www.forbes.com/sites/ericmack/2018/05/11/boston-dynamics-atlas-spotmini-robots-cant-catch-you-just-yet-but-theyre-gaining-fast/#96325aa6554a>.

²² Matthew Rosenberg and John Markoff. "The Pentagon's 'Terminator Conundrum': Robots That Could Kill on Their Own," *The New York Times* (25 October 2016): n.p. See <https://www.nytimes.com/2016/10/26/us/pentagon-artificial-intelligence-terminator.html>.

²³ Vivek Wadhwa and Aaron Johnson. "Robots could eventually replace soldiers in warfare. Is that a good thing?," *The Washington Post* (5 October 2016): n.p. See https://www.washingtonpost.com/news/innovations/wp/2016/10/05/robots-could-eventually-replace-soldiers-in-warfare-is-that-a-good-thing/?noredirect=on&utm_term=.957b6bc6c05c.

including insects, fish, and dinosaurs. The Marvel Comics films are littered with biomimetic technologies. Also, “Metalhead,” an episode of Charlie Brooker’s dystopian show *Black Mirror*, reimagined Ray Bradbury’s mechanical hounds as security devices gone awry in a post-apocalyptic future where humankind struggle to survive despite the stockpiles of supplies in warehouse distribution centers guarded by ironic, mechanical distortions of humankind’s so-called “best friend.”

While these portrayals point to Bradbury as an inspiration for plots driven by biomorphic devices, Bradbury himself pointed to Jules Verne and Herman Melville when he argued that Nemo’s *Nautilus* in Verne’s *Twenty Thousand Leagues Under the Seas* was Verne’s response to Melville’s whale, Moby-Dick: “What does Jules Verne do through *his* mad captain Nemo? He constructs. Nemo says [to Melville, or perhaps to Ahab], ‘Give me your White Whale. I will not rend it; I will rebuild it. I will weld the first mechanical whale in history, and I will name it the *Nautilus*, and I will sail the seas of the world.’”²⁴ This thin line of influence—Melville and Verne on Ray Bradbury, Bradbury on Charlie Brooker, contemporary science fiction on defense developments, defense developments on tech journalism—reveals the rhizomal history of the animalized machine, which stretches back much further than the vague references to “science fiction” have thus far exposed. This poses a significant problem for academic inquiry: how does one write a textually-informed dissertation that theorizes a trope that appears in a body of literature spanning at least two centuries?

Wonder, Wonders, and the Romance Tradition

²⁴ Ray Bradbury, “Creativity in the Space Age,” *Engineering and Science* (June 1963): 10-15. See page 11.

There are two ways to trace the biorobots that have emerged in the twenty-first century to the mechanimal as I have defined it above, and to locate the mechanimal in a specific body of literature. One might undertake a Foucauldian archaeology of knowledge that traces an historical-causal chain of influences from contemporary biorobots back to the emergence in literature of a vision for mechanimal vehicles. Another would be to identify a specific genre in which mechanimals are a central trope and explain the mechanimal in terms of its literary-historical context. Both of these approaches suggest that a *mythos* of the modern mechanimal should begin with the nineteenth century.

Consider this brief archaeology of knowledge. The curriculum vita of Raffaello D'Andrea, the roboticist mentioned above whose TED Talks feature quadcopters flying in swarm-algorithm-defined formation, lists grant funding from the United States Department of Defense (DOD), DARPA, National Science Foundation (NSF), and Air Force between the years 1998 and 2006.²⁵ DARPA's genesis in the cybernetics research that began with the Macy Conferences held from 1941 to 1960 is a well-documented fact.²⁶ Norbert Wiener, one of the central researchers in the Macy Conferences, indicated in his biography his preference for the writing of Jules Verne and H. G. Wells over what he called "modern science fiction," which he saw as formulaic. "Its slickness is quite different from the enthusiasm and verve with which Jules Verne adapted the romantic milieu of Dumas, or the sincerity by which H. G. Wells made his sociological discourses palatable and fascinating."²⁷ In the popular-level books he published

²⁵ A copy of D'Andrea's CV can be found online at raffaello.name/wp-content/uploads/2018/07/DAndreaCV2018Jul26.pdf.

²⁶ Steve Joshua Heims, *The Cybernetics Group* (Cambridge, MA: The M.I.T. Press, 1991).

²⁷ Norbert Wiener, *Ex-Prodigy: My Childhood and Youth* (New York, NY: Simon and Schuster, 1953), 84-85. In tracing this historical-causal chain of influence we have to rely on Wiener because, to my knowledge, none of the other researchers present at the Macy Conferences commented on the link between science fiction and their research. To be fair, few cybernetics researchers had the public profile that Wiener did, either.

based on his research, Wiener posed cybernetic problems inspired by Rudyard Kipling's short story, "With the Night Mail," noting that Kipling "[did] not seem to realize that where a man's word goes, and where his power of perception goes, to that point his control and in a sense his physical existence is extended. To see and to give commands to the whole world is almost the same as being everywhere. Given his limitations Kipling, nevertheless, had a poet's insight, and the situation he foresaw seems rapidly coming to pass."²⁸ Thus, the textual record indicates that one of the most influential researchers in the cybernetics movement consciously avoided what was then known as "science fiction" but was avowedly influenced by the science-influenced romances that predated it. From this, it would follow that when tech writers describe biorobots as "science fiction" becoming real, they might more accurately describe them as the becoming-real of machines found in a genre called "scientific romance," which predated science fiction.

Alternatively, one might ask how old the mechanimal trope is and where and when it first appears. This takes us at least to the Trojan Horse and the ancient Greek myths of Daedalus and others, only elongating the historical arc whose length already complicates inquiry. But the instinct to follow the history of biomimetic design is right because it points to artifacts that created wonder—to wonders. In *Wonders and the Order of Nature, 1150-1750* Lorraine Daston and Katherine Park distinguish between two types of artifactual wonders: wonders of nature, or natural wonders, and wonders of art, or artificial wonders. Wonders of nature were "actual objects from the exotic margins" of courtly knowledge that "carried with them the sense of unmediated contact with another world."²⁹ Among such objects Daston and Park include gems,

²⁸ Norbert Wiener, *The Human Use of Human Beings: Cybernetics and Society* (Boston, MA: Houghton Mifflin Company, 1954), 97.

²⁹ Lorraine Daston and Katherine Park, *Wonders and the Order of Nature: 1150-1750* (New York, NY: Zone Books, 1998), 67-68.

unicorn horns (narwhal tusks), griffin eggs (ostrich eggs), elephant tusks, eagle stones (geodes), claws, coconuts, coral, nautilus shells, and sharks' teeth, noting that such objects were collected for their own sake but also seen as "nature's noblest creations," "envelop[ing] those around them with an aura of nobility and might" born of their rarity.³⁰ By contrast, wonders of art, or artificial wonders, were made by human craft; but Daston and Park note that "Often wonders of art and nature were combined in the same piece."³¹ In order to fabricate wonders of art, artisans needed access to natural wonders and an intricate knowledge of their powers. Most wonders of art are "what we might call wonders of engineering. In addition to being decorative, they harnessed powerful natural forces to produce astounding effects. Like natural wonders, these heterogeneous creations were united by the psychology of wonder, drawing their emotional effect from their rarity and the mysteriousness of the forces and mechanisms that made them work."³² But unlike the biorobots mentioned above, wonders of art were "beautiful, intricate, precious, expensive—more akin to the work of the jeweler than that of the blacksmith," though they also "performed functions associated with the military and social elites."³³

Wonders, both natural and artificial, were useful in establishing psychological and emotional control, which amounted to political control. They embodied "a form of symbolic power over nature, over others, and over oneself," and they allowed nobles to vanquish their foes and enforce laws.³⁴ The term "wonder" can thus be said to have both an artifactual usage and a psychological usage. Both of these usages are intertwined because experiences of artifactual

³⁰ Daston and Park, 68-69.

³¹ Daston and Park, 88.

³² Daston and Park, 90.

³³ Daston and Park, 90.

³⁴ Daston and Park, 91.

wonders resulted in the psychological experience of wonder; and wonders, in both senses, were described in the romance tradition.³⁵ Therefore, we might productively ask when texts that described mechanical wonders first historically coincided with work to fabricate mechanical wonders. In fact, there is such an overlap, and it predates the science fiction to which tech writers often refer: these elements converge in a very specific, short-lived sub-genre of the romance called “scientific romance.”

Defining the Scientific Romance

The scientific romance was a late iteration of the romance, itself a discourse informed by and concerned with empire. As its name suggests, the romance is a literary form from the European continent, which informs its significance in English literature: it is not native to English, but a result of colonization and cross-cultural exchange.³⁶ Given its status as an artifact of imperialism, it comes as no surprise that, as Gillian Beer has noted, central to the romances were the perspective of the royal court and the characters of royal figures: “in romance, as in dreams, queens and kings are our representatives. Their royalty universalizes them. They revive our sense of our own omnipotence, which, though constantly assailed by adult experience, survives in the recesses of personality even after childhood.”³⁷ The medieval romances, including *Sir Gawain and the Green Knight* and other pieces of the Arthuriad, were written as courtly entertainment and recounted the adventures of knights, courtly emissaries, agents of the regent. In the nineteenth century, this older form of Romance enjoyed a resurgence in the writings of Sir Walter Scott and Alfred, Lord Tennyson, among others.

³⁵ Daston and Park, 67.

³⁶ Gillian Beer, *The Romance*, (London, England: Methuen, 1970), 5.

³⁷ Beer, 3.

Beer goes notes that the romance “invokes the past or the socially remote,”³⁸ and this invocation was essential to recounting the adventure of a wondrous encounter in a faraway place, somewhere at the margins of the court’s knowledge of the world, in the space at world’s end where early modern cartographers are now famous for scrawling warnings like “Here there be monsters.” Put differently, the possibility of encountering wonders increased in proportion to the adventurer’s distance from his home court. For this reason, the romance and the wonders it describes come to the audience as if from another world, from the farthest reaches of courtly knowledge; the psychological wonder they create is a product of this distance. It is therefore not surprising that Daston and Park have identified the romance tradition as one source of descriptions of wonders and their uses.³⁹

As the romance tradition continued, ongoing global exploration reduced the uncharted spaces in the world, resulting in several variations on the older romances that were necessary in order to sustain the possibility of wondrous encounters. These included the emergence of the narrative setting of the uncharted or lost island, as in Defoe’s *Robinson Crusoe* (1719) or Swift’s *Gulliver’s Travels* (1726); the framing of the narrative from a different central viewpoint, one less aware of the world than a regent might be, as in Shelley’s *Frankenstein* (1818) or Stevenson’s *Treasure Island* (1883); and the extension of narrative settings to environments beyond earth, as in Verne’s *De la terre à la lune* (1865). Whatever the central viewpoint and regardless of the space into which the protagonist ventures, the adventurer’s encounter with the wondrous and his return are central to the romance because they not only entertain the audience with something unheard-of, something wondrous, they also recount the adventure in a way that

³⁸ Beer, 2.

³⁹ Daston and Park, 90.

explains the existence of the story itself. Therefore, the romance had to balance reality with rarity, rational possibility or narrative plausibility with the miraculous or the marvelous.

Among the innovations that made the scientific romance scientific were the aforementioned shift in central viewpoint and setting—if the scientific method can be carried out by anyone, presumably the romance’s perspective from the royal court and its agents is obsolete—but also replacement of supernatural or miraculous wonders by wonders that could be explained rationally. One of the clearest definitions of the scientific romance, a *mutatis mutandis* description of the genre’s literary characteristics based on the medieval romance, comes from Stephen Gill, who described scientific romances as

dominated primarily by science. Usually [the scientific romance’s] basic elements are the same as those found in the original romance. For example, the incidents occur in a strange world of excitement and wonder. A knight is replaced normally by a scientist who explores hitherto unknown territory of human experiences. The scientist’s adventures can be identified with the knight’s prowess and his quest. But the unusual phenomena, as a rule, are explained in the light of scientific knowledge.⁴⁰

Gill’s definition marks the scientific romance as an intersection of wonder and science, and his substitution of the scientist for the knight implies the imperial agency of scientist-protagonists, or at least their national identities: they are not merely scientists, but *British*, or *American*, or *French* scientists. As such they are agents of their nation-states, whether they perform overtly political roles or merely function within the romance’s symbolist logic as science-influenced cultural caricatures.

The problem with Gill’s definition of *scientific romance* was that he attributed the term’s coinage to Hugo Gernsback, citing Mark Hillegas’s book *The Future as Nightmare* (1967). However, what Hillegas attributed to Gernsback was the coinage of the term *science fiction*, not

⁴⁰ Stephen Gill, *Scientific Romances of H. G. Wells* (Cornwall, ON, CAN: Vesta Publications, 1977), 28.

scientific romance. The term *scientific romance* was first used by Isaac D'Israeli in *Vaurien* (1797):

I say then, that this earth will be peopled by another order of beings; pure intelligences that will create by self-impregnations. Descartes thought that we might prolong life for two or three centuries, and when one of his disciples heard of his death, it took him two years before he could believe it. Bishop Wilkins, who discovered the art of aerial navigation, had no doubt that in a few years men would as commonly call for their wings, as they did for their boots. I quote these instances to prove that philosophers may happen to miscalculate. This last, however, led me to my dissertation on the winds; there I demonstrate that 'it *only* depends on *some very small causes* to govern them, by *always* keeping the under-currents of air from the S. W. and the upper currents from the N. E.*

* The learned reader who has a fondness for the marvelous of scientific romances, may now indulge his passion in its plenitude of fancy, by carefully reading over all that has been lately, and will be, written on the winds.⁴¹

D'Israeli's usage here suggests the scientific romance includes three types of stories: stories about self-replicating, disembodied intelligences, stories about unnaturally long life, and stories about humans who can fly. Were D'Israeli writing now he might call these stories about artificial intelligence, clinical immortality, and devices that make animal locomotion available to humans.⁴²

Each of these is at play in the emergence of the mechatronic, fundamental to which is human appropriation of nonhuman animal locomotion; and this appropriation initially took the form of biomimetic vehicles. Before radio control, computing, and microtechnology made it possible to build an animal-shaped machine that could move on its own or under remote control, a human had to be aboard, not only to pilot it but also to record whatever unique view of the

⁴¹ Isaac D'Israeli, *Vaurien: Or, Sketches of the Times, Exhibiting Views of the Philosophies, Religions, Politics, Literature, and Manners of the Age*, Vol. I (London, England: T. Cadell, Junior, and W. Davies, 1797), 87-88. I have included only part of the footnote here, which is relevant for being the first use of the phrase "scientific romance" documented in OED. See *Oxford English Dictionary Online*, s.v. "scientific."

⁴² Understood this way, D'Israeli's definition of scientific romance presaged Wiener's work to realize "self-reproducing machines." See Norbert Wiener, *Cybernetics, or Control and Communication in the Animal and the Machine* (Cambridge, MA: The M.I.T. Press, 1961), 169-180.

world it made available. But moving in ways that human bodies are not designed to move can be hazardous to one's health. Particularly after mechanical vehicles began flying, especially for military purposes, the cost of human life made artificial intelligence an appealing substitute pilot. Saving human life by substituting artificial intelligence, though not technically the same as an attempt at clinical immortality, evinces the same anthropocentrism. Here, again, Salter's work is relevant. The first stage of what might be considered the mechanical's technological evolution was the biomimetic vehicle, which only later became a biorobotic device as the wonder of flying through the air or diving below the water wore off and humans came to prefer safety to adventure.

The fact that mechanical vehicles first appeared in scientific romances reinforces this dissertation's focus on nineteenth-century British literature. To review: the earliest mechanical vehicles developed into a literary trope in the scientific romance, a kind of biomorphic wonder that is mechanically complex but formally organic, incorporating the shapes of biomaterials such as bone, tusk, claw, hoof, feather, or shell. These sorts of biomorphic wonders inspired and continue to inspire wonder because although they were made by human artisans, they moved like nonhuman animals; although they appeared to be natural entities, they served human political purposes; and although they were beautiful, they were also deadly.

Salvaging the Scientific Romance

Any attempt to study the scientific romance must account for Gary Westfahl's objection that no such genre existed, *per se*. Westfahl begins his book, *The Mechanics of Wonder* (1998),⁴³ with two premises about science fiction. First, "there are absolutely no grounds for arguing that

⁴³ I find Westfahl's title ironic, since wonder and wonders are fundamental to the romance tradition and Westfahl denies that the scientific romance existed and that it influenced science fiction.

anything resembling a ‘history of science fiction’ actually existed as a historical fact in contemporary perceptions before the nineteenth century”; and second, “any wide understanding of science fiction as a genre was at best limited and flawed until [Hugo] Gernsback’s breakthrough [defining the genre marker *science fiction*] in the 1920s.” From these premises Westfahl concludes that

if we define a genre as consisting of a body of texts related by a shared understanding of that genre as recorded in contemporary commentary, then a true history of science fiction as a genre must begin in 1926, at the time when Gernsback defined science fiction, offered a critical theory concerning its nature, purposes, and origins, and persuaded many others to accept and extend his ideas. From that point on, science fiction fits the definition of a historical genre, and we can reasonably speak of a tradition of science fiction. Further, the ideas and texts in that tradition constitute the only unambiguous and unarguable bases for discussions of science fiction.⁴⁴

As he sees it, there is one possible exception to these stringent criteria: the scientific romance.

Westfahl describes the scientific romance as a “literary tradition prior to Gernsback which was unquestionably real, undoubtedly widely acknowledged at the time, and unmistakably influential.” Nevertheless, he denies the existence of the scientific romance, as a genre, on the grounds that “the idea of the scientific romance, as it is seen between 1890 and 1920, was one that was far from universally accepted, weakly developed, and fatally incomplete.”⁴⁵ He cites two arguments: that the term “scientific romance” was mainly used by book reviewers, and that it died out. For both arguments he relies on Stableford’s dated research, which I address below. Germane here is the fact that Westfahl is obviously invested in defending both Gernsback’s status as the originator of science fiction and science fiction’s historic originality as the first identifiable genre of science-influenced fiction. As such, he is deeply concerned with dismissing the idea that any coherent, identifiable, science-influenced fiction genre existed prior to 1926,

⁴⁴ Westfahl, 8.

⁴⁵ Westfahl, 25.

and he abjures any claim that such a genre influenced Gernsback; but this is sleight-of-hand aimed at assuring Gernsback's importance in science fiction history.

The reason it is even possible for Westfahl to attempt to dismiss the existence of the scientific romance is that the term has been long neglected, occluded and misconstrued in late-twentieth-century science fiction criticism. As Gill's misattribution of the term "scientific romance" to Gernsback illustrates, science fiction scholars have long recognized Gernsback as a monumental figure in, if not the focal point of, the history of science fiction; this accounts for Westfahl's insistence that science fiction was the first and remains the only science-influenced genre of fiction literature. Indeed, Gernsback is significant. He coined the term "scientifiction" in 1926 and then changed it to "science fiction" in 1929, defining it as "the Jules Verne, H.G. Wells, and Edgar Allen Poe type of story—a charming romance intermingled with scientific fact and prophetic vision." He was obviously drawing from material that comprised an already-existing body of science-influenced fiction, works that he himself referred to as "romance," leaving little doubt that he recognized "scientifiction" as continuous with an older romance tradition. In fact, he went so far in that editorial as to call the then-emerging writers of scientifiction "the new romancers."⁴⁶ As such, scientifiction, which became science fiction, was essentially scientific romance remarketed.

After Gernsback coined the term "science fiction," defining it took the better part of the twentieth century and was complicated by anachronistic uses of it to describe earlier literature, by a critical tendency to conflate science fiction with scientific romance, and by incomplete or otherwise questionable periodization in studies of related literary history. Despite his smart

⁴⁶ Hugo Gernsback, "A New Sort of Magazine," *Amazing Stories* 1:1 (April, 1926): 3. An electronic copy of this source is available online at <https://archive.org/stream/AmazingStoriesVolume01Number01#page/n3>.

definition of the scientific romance in terms of the medieval romance tradition, Gill may be partly to blame for other scholars' conflation of the scientific romance and science fiction, for, as mentioned previously, he wrongly noted that "scientific romance came into existence in the present [i.e. the twentieth] century. Hugo Gernsback was the first publisher who coined this word in 1929."⁴⁷ What Gill meant was that Gernsback had coined the term "science fiction," not "scientific romance." After Gill, the term "scientific romance" remained a foil for expositing science fiction's history. In *Billion Year Spree* (1973) Brian Aldiss distinguished between science fiction and that darker form of the romance, the gothic, when he argued that "Science fiction was born from the Gothic mode, is hardly free of it now."⁴⁸ He would reiterate and expand that idea later when *Billion Year Spree* was revised and republished as *Trillion Year Spree* (1986).⁴⁹ In his introduction to *Science Fiction: Its Criticism and Teaching* (1980), Patrick Parrinder noted that "Science fiction itself is, for trade purposes, bracketed together with heroic fantasy, a branch of the historical romance in which nostalgia for a lost age of individualism is accentuated by the evocation of a quasi-feudal world of sorcerers and kings."⁵⁰ Both of these critics' work shows a tendency to retroactively label works that predated Gernsback as "science fiction," which, problematically, would not have been recognized as such by either their authors or those who read them when they were first published.

⁴⁷ Gill, 28.

⁴⁸ Brian Aldiss, *Billion Year Spree: The True History of Science Fiction* (New York, NY: Doubleday & Company, Inc., 1973), 18.

⁴⁹ In *Trillion Year Spree* Aldiss noted that the gothic "can incorporate and reinforce itself by the qualities of Romance and of a partial Realism. Quest novels, which enjoy such popularity in the nineteen-eighties, are clearly a blend of Gothic fantasy and veins of story-telling far more ancient." See Brian Aldiss, *Trillion Year Spree* (London, England: Victor Gollancz Ltd., 1986), 16.

⁵⁰ Patrick Parrinder, *Science Fiction: Its Criticism and Teaching* (London, England: Methuen, 1980), xv.

Such conflation of science fiction and scientific romance unduly convoluted literary history. In *Victorian Science Fiction in the U.K.* (1983) Darko Suvin studied power dynamics in works of “Victorian science fiction,” a turn of phrase complicated by the fact that “science fiction” was not an established term until 1929, well after Queen Victoria’s death, when it emerged as a genre category in the United States, an ocean away; Victorian England would not have recognized the term.⁵¹ Although Suvin’s analysis was one of the most academically respectable studies of science fiction to date, his anachronistic application of the genre marker “science fiction” to British literature from the late nineteenth century complicated other scholars’ sense of the literary historical context for the genre.

The historical periodization of the scientific romance is further complicated by Brian Stableford’s *Scientific Romance in Britain, 1890-1950* (1985), in which he argued that

What entitles us to think of scientific romances as a kind is not a set of classificatory characteristics which demarcate them as members of a set, but loose bonds of kinship which are only partly inherent in the imaginative exercise themselves and partly in the minds of authors and readers who recognise in them some degree of common cause. What binds together the authors and books to be discussed [in his book] is mainly that they were perceived by the contemporary audience as similar to one another and different from others,⁵²

which was exactly how Gernsback went about identifying the texts that he thought exemplified what he was calling “science fiction.” Stableford began his study of the scientific romance with Wells, likely because the latter was known to have called his stories “scientific romances.”

⁵¹ Here I agree with Westfahl. See Westfahl, 6. Westfahl notes that Suvin was aware of this criticism, though he anachronistically applied the term “science fiction” anyway. Although the term “Science-Fiction” was first used by William Wilson in 1851, it was neither defined nor used systematically until 1929, when Gernsback opted to use an unhyphenated form of it as a replacement for what he had initially called “scientifiction.” See William Wilson, *A Little Earnest Book upon a Great Old Subject* (London, England: Darton and Co., 1851), 139.

⁵² Brian Stableford, *The Scientific Romance in Britain, 1890-1950* (New York, NY: St. Martin’s Press, 1985), 4.

However, other authors used the term earlier than Wells did. One of these was Jules Verne.⁵³ Another was Charles Howard Hinton, whose 1884 pamphlets entitled *Scientific Romances* are often cited—wrongly, given D’Israeli’s earlier use—as the emergence of the term.⁵⁴ All of these nineteenth-century uses suggest that Stableford’s account should be read as dealing with only the latter part of the arc of the scientific romance’s history. The combined effect of Suvin’s and Stableford’s books suggested that science fiction was nineteenth-century literature and scientific romance was twentieth-century literature, a perplexing conclusion, given that the romance is centuries older than the novel and has been construed by some—Beer, for instance—to have waned with the dawn of the twentieth century.

In the late-1980’s and early-1990’s, two works helped to rectify the problem of the scientific romance’s periodization. One was Aldiss’s *Trillion Year Spree*. To Suvin’s credit, he had acknowledged the importance of the year 1800 as a “turning point” in the development of science fiction and was thus not far off the date of D’Israeli’s *Vaurien*. Aldiss reinforced this date by beginning his revised history of science fiction with Mary Shelley’s *Frankenstein*, which, if not the first, is at least the most famous “scientific romance,” in D’Israeli’s sense, published in the first half of the nineteenth century. Following Stableford’s terminology, Nicholas Ruddick’s *British Science Fiction* (1992), identified a period from Thomas More to H. G. Wells that he called “the Descent of the Scientific Romance.” In Ruddick’s periodization, the years during which Wells was writing comprised “the Wellsian Synthesis.” Ruddick used the

⁵³ Marie Belloc, “Jules Verne at Home,” *The Jules Verne Companion*, ed. Peter Haining (Norwich, England: Fletcher & Son, 1978), 22.

⁵⁴ Westfahl, 25. Since he draws from Stableford in other respects, Westfahl may be repeating Stableford’s error on this matter, for which see Stableford, 5. To be fair, Stableford and other historians of science fiction began the research at a time when search engines made it much more difficult to find a string of text in the ocean of what had been written. As digitization has improved over the years, it makes sense that D’Israeli’s use of the term “scientific romances” has come to light.

term “scientific romance” to describe texts from prior to the Wellsian Synthesis (texts that Gernsback had referred to in defining “scientifiction”) and he defined “science fiction” as beginning after the Wellsian Synthesis, though he also allowed for Stableford’s theory that the scientific romance continued on until about 1950. Ruddick’s version of science fiction history makes the most sense of the two genres’ temporal relationship and best explains Gernsback’s use of the term “romance” in defining “scientifiction.”

More recently, John Rieder has heralded the end of the agonistic effort to define the genre of science fiction in *Colonialism and the Emergence of Science Fiction* (2008). Rieder observed that “Science fiction comes into [historical] visibility first in those countries most heavily involved in imperialist projects—France and England—and then gains popularity in the United States, Germany, and Russia as those countries also enter into more and more serious imperial competition.”⁵⁵ Not only does this sequence of cultural transmission complicate any attempt to lionize Gernsback, Rieder also recognizes that science fiction scholars’ attempts to define science fiction were becoming imperialistic by privileging the Western cultures whence the genre emerged. Moreover, among the features of science fiction, Rieder identifies imperialism, particularly the imperial gaze, which he sees as an aspect of a more pervasive imperialism within science fiction. For these reasons, in *Colonialism* Rieder refuses to define the term “science fiction,” framing it instead as a web of resemblances “that can be traced backward from Gernsback’s baptism of the genre along a variety of paths, and that can be extended in an

⁵⁵ John Rieder, *Colonialism and the Emergence of Science Fiction* (Middletown, CT: Wesleyan University Press, 2008), 3. With regard to that French and English emergence, Florian Krobb has offered an incisive reading of Verne’s treatment of Africa, and Alex Kirstukas, who recently translated Verne’s *Robur le Conquerant* into English, puzzled over themes in the story that he perceives as racist and imperialist. See Florian Krobb, “Imaginary Conquest and Epistemology in Nineteenth-Century Adventure Literature: Africa in Jules Verne, Burmann, May, and Twain,” *Children’s Literature* (44): 1-20. See also Jules Verne, *Robur the Conqueror*, trans. Alex Kirstukas (Middletown, CT: Wesleyan University Press, 2017), xiv.

unpredictable number of new and different ways.”⁵⁶ Rieder sees this as a “break with Suvinian formalism,” an allusion to Suvin’s legacy of perspicuous genre definitions, as seen in *Victorian Science Fiction in the U.K.*⁵⁷

Those who welcome Rieder’s post-generic proclamation might object that my approach here is a return to the Suvinian formalism from which Rieder has liberated science fiction scholars, or that, as a critical move, the attention I give to defining the scientific romance as a genre reenacts the imperialism of efforts to define the genre of science fiction: I abjure both charges. For one thing, this dissertation is not a work of science fiction scholarship *per se*, but an attempt to mark the emergence of the mechanimal in literature. Scientific romance is relevant only as my locus of inquiry here, since it historically coincided with the intersection of imperial values, animal science, and technological discourse on the possible workings of future machines. Moreover, far from adding to the imperialism of science fiction scholarship,⁵⁸ my aim is to uncover the history of the scientific romance and offer an account of its technological vision that is honest about the extent of empire’s influence on the biomimetic machines imagined by its writers. Although I follow Tom Shippey in arguing that science fiction is a remarketing of the scientific romance, that argument should not inhibit non-Western writers’ and readers’ access to science fiction in the future.⁵⁹ On the contrary, I see Rieder’s and my critiques as working in

⁵⁶ Rieder, *Colonialism*, 17.

⁵⁷ Suvin’s work tended to focus on the class dynamics addressed by science fiction but set aside the imperial political context of the late-nineteenth-century science-influenced fiction he was studying.

⁵⁸ And by this I surmise that Rieder is referring to American science fiction scholars’ attempts to ensconce Hugo Gernsback as the patron saint of the genre, which, when done insistently, comes off as nationalist or culturally hegemonic.

⁵⁹ According to Westfahl, “the tradition of the scientific romance eventually died out,” a claim to which I am unwilling to commit. See Gary Westfahl, *The Mechanics of Wonder: The Creation of the Idea of Science Fiction* (Liverpool, England: Liverpool University Press, 1998), 25. Arguably, the genre lives on, particularly in other media, including the first-person shooter video game, which invites the player to perform the role of adventurer and explore of the nether world of the game’s virtual space. Often, such exploration entails encounters with monsters or monstrous adversaries, and with magic or marvelous technologies, many of them mechanimal in

harmony: whereas Rieder seeks to decolonize science fiction and science fiction scholarship in an effort to facilitate their continued development as truly international discourses, I am concerned with defining scientific romance in a way that makes it a new horizon for future decolonization efforts, so that the influential texts of the past become more recognizable as problematically colonized, and perhaps more salvageable.

Lastly, Westfahl's denial does not account for Tom Shippey's theory that science fiction endured a "long gestation as 'scientific romance' (largely in Britain), crossed the Atlantic, and entered the domain of 'the pulps'" in the United States.⁶⁰ Shippey is a medievalist who has written extensively on the history of language and of the romance, in both its medieval and modern forms; he has also written science fiction and therefore has an appreciation of the genre's importance. Tellingly, he emphasizes the continuity between scientific romance and science fiction, which he defines as "fabril literature," literature about making. Fabril literature is "overwhelmingly urban, disruptive, future-oriented, eager for novelty; its central image is the 'faber', the smith or blacksmith in older usage, but now extended in science fiction to mean the creator of artefacts in general—metallic, crystalline, genetic, or even social."⁶¹ For example, Frankenstein is a faber, his materials are biological, and the large scale on which he is working and the mechanical animation process he uses to give life to his creature suggest he is more akin to a blacksmith than a jeweler, to invert Daston's and Park's wording, quoted below. In placing

the sense I have defined it above. When the adventure ends, the errant gamer returns home to the court of his—often it is "his"—own basement. Certain science-influenced genres of cinema, for example, the Marvel Universe, offer similar romantic adventures. So, to say with certainty that the scientific romance is dead prematurely forecloses a great deal of potentially fruitful critical inquiry for the cultural studies scholar. Certainly, as a literary genre it has fallen out of fashion; but the question of whether it lives on in other media is a matter for ongoing discussion.

⁶⁰ Tom Shippey, "Introduction," *The Oxford Book of Science Fiction Stories* (Oxford, England: Oxford University Press, 2003), ix, xv-xvi.

⁶¹ Shippey, ix.

an emphasis on making, Shippey's notion of "fabril literature" helpfully connects the old scientific romantic tradition, much of which is derived from Shelley's *Frankenstein*, with twenty-first-century fabricators, such as those whose work has been featured in TED Talks over the past decade.

Conclusion

So, the mechanimal is best sought in the pages of scientific romances, which we can date roughly from D'Israeli's definition in 1797 through Gernsback's remarketing of the genre as science fiction in 1926. Since this is a British literature dissertation, I intend to focus on texts that were read in Britain, though they may have been written elsewhere, and I set the scientific romance against a period of British history characterized by the development of modern machines, particularly vehicles.

In the first chapter, I read Butler's *Erewhon* as a synthesis of the social, scientific, technological, and geopolitical preconditions for the mechanimal vision that emerged in later scientific romances. Butler saw the ingenuity required to construct mechanical modes of transportation as essentially British and described such ingenuity in evolutionary terms. I argue that Higgs, Butler's protagonist, is a morphological study in the corporeal-evolutionary implications of this British ingenuity.

This evolutionary perspective lends valuable context to "The Book of the Machines," a three-chapter stretch in which Butler alternately considers machines as human appendages and as a species in their own right, views I refer to, respectively, as Butler's Protheses Theory and New Species Theory. The Erewhonians have ordered their society on the New Species Theory and view machines with Luddite suspicion and fear, stamping out all but the crudest machines in a bid to retain human evolutionary superiority. By contrast, Higgs demonstrates an increasing

ability to use and make machines, making him a case study on the Prostheses Theory. He begins by using biological bodies, including a horse and a human, to move over land, then develops a crude raft to cross a liminal river, and finally, marshals the labor of a society, Erewhon, to fashion an airship in which he and his lady-love, Arowhena, escape the social restrictions that would prevent their marriage. As such, Higgs's essentially British ingenuity perpetuates his genetic line and ensures the couple's safe return to London. *Erewhon's* conclusion reveals that Higgs's story is a solicitation for shareholders in his new endeavor, the Erewhon Evangelisation Company, with which he intends to Christianize the Erewhonians while transporting them to Queensland to serve as laborers in the emerging sugar industry. In Butler's final estimation, British mechanical-evolutionary ingenuity serves the empire's purposes by trafficking human labor along imperial networks to advance the colonial economy (and fill Higgs's own pockets). Imperialism and mercantilism are essential to the milieu whence the mechanimal vision emerged, and they constitute the *sine qua non* of its subsequent development.

Butler's "The Book of the Machines" informs my approach to Jules Verne's *Twenty Thousand Leagues* in the second chapter. Whereas he dismissed the animalization of machines as "puerile" and the work to taxonomize them as "a digression," Verne made a career of designing animal-like machines, which feature prominently in his vast *oeuvre*, parts of which read as just such a mechanical taxonomy. The mechanimal trope emerges in *Twenty Thousand Leagues* when Verne's protagonist, the anatomist Pierre Aronnax, his butler, Conseil, and their friend, the harpooner Ned Land, are thrown overboard somewhere in the Pacific Ocean during a hunt for what Aronnax believes is a giant narwhal; the "monster" turns out to be a biomimetic submarine, Captain Nemo's *Nautilus*. I trace the *Nautilus's* technological descent from the nef, a

type of Renaissance wonder shaped like a ship and constructed of precious metals and nautilus shell, and from the Royal Navy's polar exploration vessels, with which Verne was fascinated.

This descent explains Verne's broad appeal in the anglophone world, both in his own time and in the twentieth century. Verne's influence on Octave Chanute and Igor Sikorsky is already well documented. Chanute, a French-born Chicago engineer, was the hub of an international network of correspondence on aviation research that included Louis Blériot and Alberto Santos-Dumont in France, Louis-Pierre Mouillard in Egypt, his friends the Wright Brothers in the U.S., Lawrence Hargrave in Australia, and Otto Lilienthal in Germany. Sikorsky, a Russian-born inventor who immigrated to the U.S., is credited with inventing and flying the first helicopter. However, Verne's influence on Norbert Wiener is frequently overlooked. Wiener was a prominent figure in the Macy Conferences held in New York in the mid-1940s, and his research, which began with automating warships' guns and issued in what is now famously known as cybernetics, found a home at the Advanced Research Projects Agency (ARPA), the precursor to the Defense Advanced Research Projects Agency (DARPA), which has funded much of the biorobotic development mentioned at the beginning of this introduction.

Whereas Verne described the mechanimal with the rhetoric of wonder, Tom Greer, a little-known Irish author, portrayed the mechanimal as a terror in *A Modern Daedalus*. Writing after George Chesney's *The Battle of Dorking*, a future-war fiction that evoked considerable English fear of invasion, Greer imagined a mechanimal prosthesis with which his inventor-protagonist, John O'Halloran, disrupts London in a bid to sell his new device. Owing to Parliament's resistance, motivated by military and economic interests, and jingoism, which prevents the English from believing that anything other than an Irish plot is afoot, O'Halloran is

incarcerated, escapes, and trains a brigade of flying commandos that bomb Royal Navy ironclads and a British expeditionary force sent to quell an Irish rising.

In chapter three I read Greer's story as an anti-imperial critique in which O'Halloran's wings conjured fear in his English readers that the science behind flight, commonly observable in avian species, might be discovered by one of the Empire's colonized before it could be discovered by the English themselves. This fear was rooted in the knowledge Greer's mechanimal offers, a long-coveted cartographic perspective known as "the bird's-eye view." In *A Modern Daedalus*, the bird's-eye view dehumanizes O'Halloran's enemies and, in Peter Sloterdijk's sense of the term, "explicates" the conditions of their survival: it makes obvious the material conditions of their remaining alive. Simultaneously, Greer's mechanimal affords O'Halloran a position from which to rain hell upon his country's colonizers. As such, *A Modern Daedalus* challenges the particularism in Butler's view that mechanical evolution was characteristically British, suggesting instead that colonization might have inadvertently resulted in a fully trained insurgence capable of appropriating the imperial vision and surpassing the metropole.

However, the empire always strikes back. In Chapter IV I demonstrate the ways that H. G. Wells's *The War in the Air* propagandistically manipulated the United States into allying with England against Germany and the way it cultivated his readers' fear of and exacerbated their prejudices toward China and Japan. Historically, Wells has dazzled his commentators—many of the earliest were also fans—with the accuracy of his portrayals of the future. In his own lifetime he presumptuously postured as a prophet and marketed his work as scientific prophecy. I depart from the critical tendency to take Wells on his own terms, from the narrative of a progressive mind restlessly imagining the modern future, and argue that Wells was a politically-

connected propagandist frustrated with his own country's slow technological development, anxious to influence some other country to realize his ideas. He did not prophetically foretell the technological future: he shaped it with so much writing, so many political connections, and a talent for persuading through fiction by playing on people's desire for wonder and on their worst fears. This admixture of wonder and fear led American readers and their political leaders to adapt their already-teeming technological ecosystem of mechanical vehicles to an increasingly competitive geopolitical milieu. Whereas Wells believed that developing mechanical vehicles, particularly flying-machines, would ensure the United States's leadership toward a World State, in actual fact American production intensified the facets of modernity that had already led Europe into a Great War, and, not surprisingly, issued in World War II and the regional wars that wracked Korea, Vietnam, and the Middle East during the latter half of the twentieth century.

In the epilogue I briefly situate this literary history of the mechanical in conversation with the new materialisms, particularly Deleuze and Guattari, and with the animal studies that emerged alongside, and in Graham Huggan's and Helen Tiffin's work, as part of postcolonial ecocriticism. In some ways, the mechanical is an assemblage in Jane Bennett's sense, which she has explicated and extended from Deleuze's and Guattari's work.⁶² The history I offer evinces interesting connections between literature, nineteenth-century scientific inquiry, nineteenth-century politics, and technology, and it was occasioned by twenty-first-century technology discourses on drones and biorobotics. Formally, it is rhizomatic. Functionally, it is something of an assemblage. Ultimately, it invites a line of thinking aimed at preventing the mechanical from becoming, in Timothy Morton's sense of the term, a "hyperobject."

⁶² Jane Bennett, *Vibrant Matter: A Political Ecology of Things* (Raleigh, NC: Duke University Press, 2020).

Chapter I: The Butlerian Synthesis: Mechanicity, Evolution, and Imperialism

Things are in the saddle, and ride mankind.

Ralph Waldo Emerson, "Ode"

If the power were granted you
to break out of your cells,
but the imagination fails
and the doors of the senses close
on the child within,
you would dare to be changed,
as you are changing now,
into the shape you dread
beyond the merely human.
A dry fire eats you.
Fat drips from your bones.
The flutes of your gills discolor.
You have become a ship for parasites.
The great clock of your life
is slowing down,
and the small clocks run wild.
For this you were born.

Stanley Kunitz, "King of the River"

Samuel Butler is famous for applying evolutionary theory to machines in a time when many were preoccupied with the implications of Darwinism. The editorials in which he first theorized machine evolution eventually became "The Book of the Machines," three chapters that comprise the core of his scientific romance, *Erewhon*. In *Erewhon*, Butler synthesized for his Victorian readers the concepts that were essential for imagining the mechanimal and for recognizing its usefulness to the British Empire: mechanicity, evolution, and imperialism. To clarify: Butler did not envision an animal-shaped machine. In fact, he brashly declared "that hardly any mistake would be more puerile than to individualize and animalize the at present existing machines." However, Butler was intensely interested in *mechanicity* over and against *machines*, for he continued that thought thus: "yet we can see no *a priori* objection to the gradual development of

a mechanical life.”¹¹⁵ Mechanicity, as Butler imagined it, was animal in the sense that it evolved. The mechanimal body was imagined by Jules Verne, who was writing around the same time and whose work I address in Chapter II. Verne imagined what he portrayed as future machines, inspiring wonder in his readers by suggesting that the vehicles that made his extraordinary voyages possible could someday become real. However, without Butler’s theories of machine evolution, which hinted at a scientific explanation of how machines like Verne’s could come to be, Verne’s wondrous future machines were far less realistic. Thus, the wonder that Verne’s machines inspired was predicated on an appreciation of the scientific, social, industrial, and political conditions that Butler synthesized in *Erewhon*, making *Erewhon* a good starting place for understanding the mechanimal.

Butler theorized machine evolution in two ways, through the voices of two different authors from Erewhon’s ancient history. First, he suggested that mechanicity was a new species, an overman that would emerge thanks to human labor and that would enslave humans by requiring them to go on working on machines, lest the machines fall into ruin and destroy humanity at a time when people could not remember how to survive without them. We might call this the New Species Theory, and its author the New Species Theorist. Once upon a time, Erewhon, the society that lends its name to Butler’s book, embraced the New Species Theory and followed the New Species Theorist’s entreaty that all but the simplest machines be destroyed, lest Erewhonian culture evolve into a machine-dependent way of life. Erewhon became a pastoral utopia, featuring only the simplest tools; this is the state in which Higgs, Butler’s protagonist, encounters it.

¹¹⁵ Samuel Butler, “The Mechanical Creation,” *A First Year in Canterbury Settlement, and Other Early Essays* (London, England: Jonathan Cape, 1923), 233. Does this make Butler the first posthumanist?

In his second theory of machine evolution, Butler argued that machines are prostheses, tools of varying complexity that enhance the human body and, in the most sophisticated instances, extend humans' agency across space. While this version of machine evolution did not logically preclude the 'enslavement' that concerned the New Species Theorist—whether one sees them as a new species or as prostheses, machines require maintenance and their human users do come to rely on them—it did acknowledge the ways that machines empower their human users and it heralded the social and economic benefits of that empowerment. We might refer to this version of Butler's theory of machine evolution as the Prostheses Theory, and to its fictitious author as the Prostheses Theorist. In *Erewhon's* history, the Prostheses Theorist lost popular confidence, and his view was recorded and preserved, it seems, simply for posterity, a memento of the way Erewhonian society might have gone but did not, for presumably obvious reasons rooted in the foolishness of his position.

But a closer reading of *Erewhon* reveals that Butler wrote Higgs as an exemplar of the Prostheses Theory, for Higgs demonstrates a remarkable ability to adapt to the wild beyond the boundaries of his colony (which is implicitly located in New Zealand) by developing simple machines. These machines not only get Higgs into the lost, insular society of Erewhon over the mountain range beyond the colony's borders, they also get him *out* of Erewhon, and with Arowhena, an Erewhonian woman with whom he falls in love. Erewhonian society forbids their union, and Higgs's ability to devise and construct machines results in his adventure and return, and thus also with his encounter with a mate, which ensures the perpetuation of his genetics.

The closing pages of *Erewhon* reveal that Higgs's account is an advertisement for shareholders in his new enterprise, the Erewhon Evangelisation Company, which will return to Erewhon and transport the Erewhonians out of their cocooned society to Queensland, Australia,

where there is great need of labor on the sugar plantations. Higgs's adaptability stands as proof of his business concept, for he adapts human and animal bodies and constructs simple machines particularly for the purpose of transportation. Moreover, the fact that Arowhena has accompanied him to England proves Higgs's ability to convince the Erewhonians to leave their country. Higgs assures himself and the Londoners whom he is soliciting that in transporting the Erewhonians his company will "convert the Erewhonians not only into good Christians but into a source of considerable profit to the shareholders."¹¹⁶ His sincerity on this point is debatable, and Butler's regular deployment of religious and religious-sounding rationales contributed to a critical consensus that *Erewhon* is a satire, both when it was originally published and in the century since. Though he might have agreed with certain tenets of Christian doctrine, Butler opposed their institutional manifestations. But to some extent, reading *Erewhon* as satire diverts critical focus from those facets of the story about which Butler was actually quite serious, and it suggests instead a critical search for whatever Butler 'really meant' by passages that are presumed to be satirical.

Therefore, in this chapter I begin with "The Book of the Machines," a passage of *Erewhon* about which Butler was very serious. After all, the newspaper articles that comprised its early drafts were among some of the first of his writings to be published, and they were published by editorial review, certifying their importance to Butler's contemporaries, whereas the rest of Butler's work was self-published, regardless of the criticism it drew. Although Butler was often at variance with his contemporaries, "The Book of the Machines" represents some of his earliest, best-understood, and most-appreciated writing. Working from "The Book of the Machines," I read the chapters that recount Higgs's entry into Erewhon as a morphology of the

¹¹⁶ Samuel Butler, *Erewhon*, ed. Peter Mudford (New York, NY: Penguin Books, 1985), 258.

British colonist that Butler intended as demonstration of the Protheses Theory. That Butler deployed this morphology in all seriousness is supported by his later attacks on Charles Darwin and his theory of evolution, which is best represented in the *New Species Theory*. Butler disliked Darwinian evolution because he found it too determinist: he thought it precluded any possibility of divine purpose or of human free agency working within an evolving world.¹¹⁷ Increasingly, Butler's perspective on evolution followed the thinking of Jean Baptiste Lamarck, whose emphasis on biological development through the repetition of habit is reflected in the Protheses Theory. This Lamarckian approach left room for human agency, including creativity, and allowed for both human and divine purpose to inform the process of both an individual's and a population's biological development.

Given Butler's ardent defense of teleological evolutionary development and of human agency's role in it, it is impossible to ignore the issue central to Butler's theories of machine evolution: development. Butler was serious about the Protheses Theory and he wrote Higgs as an exemplar of it. Whatever *Erewhon* lampoons, then, it seems to be serious about both the individual and social benefits of the biological adaptability inherent in tool-making. And given that Butler's tool-making character is a specifically British protagonist, whatever about colonists Butler might have been satirizing, he assumed their ability to develop quickly, where development includes both a corporeal-evolutionary dimension and an economic-imperial one.

One problem with Butler's morphological approach to British adaptability is that it did not age well. As Ernst Haeckel's famous dictum "ontogeny recapitulates phylogeny" became biological orthodoxy, Higgs was open to a nationalist reading in which he was emblematic of Britishness, such that Butler's point could be inverted: the British were adaptable, yes, but

¹¹⁷ See Mudford's notes in Butler, *Erewhon*, 266.

adaptability was also characteristically British. I am not arguing that this was Butler's perspective; I am arguing that the way he wrote Higgs opened the otherwise-slippery text of *Erewhon* to such a reading. Butler tended to confuse his readers, and confused readers often interpolate what is familiar and comfortable. The ideas that the British were a machine-making people and that this mechanizing adaptability made them capable of civilizing foreign, undeveloped others for their own good resonated with increasingly jingoist Victorian sensibilities and served Britain's increasingly nationalist outlook on Continental Europe and the rest of the world that is so evident in the writings of other Victorians, for example Rudyard Kipling, Arthur Conan Doyle, and H. G. Wells. And so, even in the event Butler deployed a tool-making Higgs in satirical critique, his backhanded rapacity was all too easily coopted into the logic of imperialism.

Butler's Theories of Mechanical Evolution

Butler's theories of mechanical evolution were central to the literary structure of the first edition of *Erewhon*, for they were originally placed right before the episode recounting Higgs's climactic escape from Erewhon in a balloon. Many contemporary editions of the text feature Butler's chapters on the rights of animals and the rights of vegetables, which he inserted after "The Book of the Machines" but before Higgs's escape when he revised *Erewhon* for the 1901 edition. The overall effect was to distance the conclusion of "The Book of the Machines" from the Higgs's escape within the geography of the text, and this literary distance diffused the point of the second half of "The Book of the Machines" in which the Prostheses Theorist asks, "Who shall deny that one who can tack on a special train to his identity, and go wheresoever he will whensoever he pleases, is more highly organised than he who, should he wish for the same power, might wish for the wings of a bird with equal chance of getting them; and whose legs are

his only means of locomotion?”¹¹⁸ When followed immediately by the balloon escape, this question signals the reader to read Higgs’s vehicular adaptability in terms of the Prostheses Theory. This textual distance also dulls the evolutionary and political implications of Higgs’s escape, which not only ensures his marriage to a liberated Arowhena, but also stands as one society’s technological outwitting of another, as Britain’s besting of Erewhon.

In order to regain a sense of this competition between societies in general, and between Britain and Erewhon in particular, as one of the stakes of Butler’s theories of machine evolution, some exposition of “The Book of the Machines” is necessary. Butler structured his theories in “The Book of the Machines” as an ontological dilemma: either machines are a new species, or they are humans’ prostheses. The New Species Theory, which receives the most attention in “The Book of the Machines,” describes machines as an emerging form of life, a species unto themselves, but not living in the same sense as humans and other biological species, nor in any sense that humans could readily understand. In “The Mechanical Creation,” one of the essays in which he originally worked out his theories of machine evolution, Butler indicated that mechanical life “shall be so different from ours that it is only by a severe discipline that we can think of it as life at all.”¹¹⁹

To some extent, this an overstatement because the New Species Theory is based on a reverse-Cartesian analogy that attributes to machines many biological traits that, by the time Butler was writing, had piqued the interest of anatomists and physiologists. In comparing automata with animals, Descartes called the animal body “a machine which, having been made by the hands of God, is incomparably better ordered and has within itself movements far more

¹¹⁸ Butler, *Erewhon*, 225.

¹¹⁹ Butler, “The Mechanical Creation,” 233.

wondrous than any of those that can be invented by men.”¹²⁰ Butler reversed Descartes’s application of the analogy, reading machines as similar to biological bodies instead of the other way around. For example:

just as we see that man and many of the lower animals share like modes of eating, drinking, and sleeping; thus they have hearts which beat as ours, veins and arteries, eyes, ears, and noses; they sigh even in their sleep, and weep and yawn; they are affected by their children; they feel pleasure and pain, hope, fear, anger, shame; they have memory and prescience; they know that if certain things happen to them they will die, and they fear death as much as we do; they communicate their thoughts to one another, and some of them deliberately act in concert.¹²¹

According to the New Species Theory then, machines are living in the sense that they move, their physical bodies are organized, and their mechanical functions tend to mirror the biological functions of many organic species.

However, the New Species Theory also recognizes that the emergence and sustenance of machine lifeforms depend upon human labor.

The lower animals progress because they struggle with one another; the weaker die, the stronger breed and transmit their strength. The machines being of themselves unable to struggle, have got man to do their struggling for them: as long as he fulfills this function duly, all goes well with him—at least he thinks so; but the moment he fails to do his best for the advancement of machinery by encouraging the good and destroying the bad, he is left behind in the race of competition; and this means that he will be made uncomfortable in a variety of ways, and perhaps die.¹²²

Modern humans are at risk of becoming enslaved by machines. But the premise that a machine species can only emerge by human labor leads also to the conclusion that non-machinic humans or anti-modern societies run a greater risk of extinction because they are at risk of being out-evolved by machinic humans and modern societies. This is the relationship between,

¹²⁰ René Descartes, *Discourse on Method and Meditations on First Philosophy* (Indianapolis, IN: Hackett Publishing Company, 1998), 31.

¹²¹ Butler, *Erewhon*, 208.

¹²² Butler, *Erewhon*, 207.

respectively, Erewhon and Britain, and Butler seems to have intentionally established this binary to illustrate his theories.

In contrast with the New Species Theory, the Prostheses Theory argues that machines are not a species of their own but extensions of human corporeality, prostheses through which humans extend their causal agency. Butler wrote this version of machine evolution as an historical relic preserved in “The Book of the Machines” as a memory of the opposition to the New Species Theory, which took hold of Erewhon. Higgs’s account quotes the Prostheses Theorist thus: “Man, he said, was a machinate mammal. The lower animals keep all their limbs at home in their own bodies, but many of man’s are loose, and lie about detached, now here and now there, in various parts of the world—some being kept always handy for contingent use, and others being occasionally hundreds of miles away. A machine is merely a supplementary limb; this is the be all and end all of machinery.”¹²³

The Prostheses Theory questions the idea that machines will help some humans out-evolve others and instead emphasizes the ways that machines mitigate human biological exertion and, in turn, facilitate biological degeneracy. According to Higgs, the Prostheses Theorist was concerned that “the machines would so equalise men’s powers, and so lessen the severity of competition, that many persons of inferior physique would escape detection and transmit their inferiority to their descendants. He feared that the removal of the present pressure might cause a degeneracy of the human race,”¹²⁴ where “the human race” as the Prostheses Theorist knew it was limited to the Erewhonians. The Prostheses Theory appears in “The Book of the Machines” to help the reader understand the relationship between Britain and Erewhon, because the story of

¹²³ Butler, *Erewhon*, 223.

¹²⁴ Butler, *Erewhon*, 224.

Higgs's adaptive tool-making reflects the history of Britain's expansion, and its juxtaposition with an Erewhon which has been ordered on the New Species Theory informs the story of contact between two races of people, one machinic, one non-machinic.

Notes on the Genre of *Erewhon*

There has been no overt argument in Butler criticism over the genre of *Erewhon*, but scholars tend to read the story as either a novel or some form of the romance. The centrality of Higgs's tool-making to the contact between Britain and Erewhon informs my choice to read *Erewhon* as a romance, but both readings make sense of the story, owing to its publication during "the later history of the romance," as Gillian Beer has called it, which she sees as "inextricable from the development of the novel."¹²⁵ Here I am particularly interested in how the choice between reading *Erewhon* as a novel and reading it as a romance shapes one's interpretation of Butler's portrayal of imperialism. Indeed, critics who read *Erewhon* as a novel readily recognize its imperial situation. For example, Anna Neill has noted that "Where the great Victorian novel represents the tangle of human and non-human beings through the intertwining of agencies that gives depth and complexity to human characters, or that animates non-human ones, *Erewhon* highlights a modern form of human autonomy that is nonetheless bound closely to the machine."¹²⁶ Neill traces immense, intricate networks—both social and causal—through *Erewhon*:

What is unique to human beings among animals is a machinate corporeality, the result of deliberate foresight and self-modification that has made civilization possible, thus further distancing us from our animal relatives, and also from those members of the human species whose tool-use entails less extension. Not only, therefore, are civilized men able to stretch their bodies out across the globe and through the engines that draw remote

¹²⁵ Gillian Beer, *The Romance* (London, England: Methuen, 1970), 7.

¹²⁶ Anna Neill, "The Made Man and the 'Minor' Novel: *Erewhon*, ANT, and Empire," *Victorian Studies* 60:1 (2018): 53-73; see pg. 69.

regions of the empire together—mobilizing labor and consolidating capital—but also their very particular kind of humanness originates in the abstractions of machine-enhanced labor power in the global marketplace.¹²⁷

Neill sees such networks as common in the Victorian novel—the genre’s realism may include imperial structures, which may affect its characters. However, imperial values are not essential to the novel as a genre, nor to the perspectives from novels are narrated. By contrast, imperial politics are the *sine qua non* of the romance, which has historically recounted the adventures of some agent of the imperial center—of the royal court during the medieval period, for example, and of the metropole in the nineteenth century, particularly after 1850—and the adventure is normally recounted in terms that evince imperial values or the imperial perspective.

Moreover, I would argue that one function of the romance’s empire-influenced perspective is the genre’s history of modifying its protagonists through tool-use; in the scientific romances of the nineteenth century, this modification becomes forward-looking. Thus, the *Gawain*-poet describes Gringolet’s¹²⁸ finery in as much detail as Gawain’s and gives the reader a careful description of Gawain’s weapons. Likewise, *Crusoe* is as much a story about a ship and its afterlife as the implements of a one-man European colony as it is about the castaway who salvages and repurposes his ship’s parts before returning to tell the tale. In his comparative study of the epic and the romance, W. P. Ker has argued that the epic was intensively realist about the inner lives and interpersonal dynamics of its characters, even if they tended to express themselves in a staid and stately manner. Ker sees the romance as an evolution from the social pressures of this psychological and relational realism and rhetorical staidness, as a liberation into

¹²⁷ Neill, 68.

¹²⁸ Gringolet was Sir Gawain’s horse.

“successive experiments of the imagination.”¹²⁹ Two such experiments, which coalesce in the romance, are to arm the adventurer with human-made equipage, and to imagine him then, wandering alone, enveloped in the natural landscape, as a kind of animal: “The favorite adventure of medieval romance is something different,— a knight riding alone through a forest; another knight; a shock of lances; a fight on foot with swords, ‘racing, tracing, and foining like two wild boards’; then, perhaps, recognition—the two knights belong to the same household and are engaged in the same quest.”¹³⁰ In the nineteenth century, the quest’s centrality to the romance inspired its writers to envision the equipage of the future, devices that modified adventurers and permitted them to tackle grander adventures, the accounts of which advanced the romance tradition itself. In this regard, modern machinery was a tool of late-nineteenth-century romance, and romances from this period should be read as incremental advances to the romance genre made by modernizing their protagonists’ equipage. But to what purpose? Always, these protagonists are driven to expand the borders of the land they call home.

It is no wonder, then, that *Erewhon* is often read as a romance. Parrinder nuances *Erewhon* as a “dystopian romance, in which the narrative standpoint is external to dystopia and the plot is that of a travelogue or adventure tale.”¹³¹ Gooch equivocates somewhat on genre—“the novel’s opening chapters integrate Higgs’s narration of events with the comedy of his ironic linguistic reversals, and the results situate the novel as a kind of romance”¹³²—but despite his own linguistic reversal here, his description suggests that *Erewhon* is a romance written at the

¹²⁹ W. P. Ker, *Epic and Romance: Essays on Medieval Literature* (London, England: MacMillan and Co., 1922), 4.

¹³⁰ Ker, 5-6.

¹³¹ Patrick Parrinder, “Entering Dystopia, Entering *Erewhon*,” *Critical Survey* 17:1 (2005): 6-21.

¹³² Joshua A. Gooch, “Figures of Nineteenth-Century Biopower in Samuel Butler’s *Erewhon*,” *Nineteenth-Century Contexts* 36:1 (2014): 53-71.

historical waning of the romance and the waxing of the novel, as Beer's study has indicated. In keeping with Ker's definition of the romance, Zemka has noted that "*Erewhon* narrates a world which fulfills the ideological fantasy of settler colonialism," which she sees as a function of the story's "pastiche of temporal signifiers." *Erewhon* itself is "A post-mechanical agrarian paradise that surrounds a modern city devoid of signs of labor and industry... cut off from the empirical order of the [British imperial] present."¹³³ Although Smithies refers to *Erewhon* as a "dystopian epic," he also notes that the British colonization "looks like a collaborative project pressed home as much by myriad sojourners and entrepreneurs"—he sees Butler as one of these—"as by permanent colonists." If Butler wrote *Erewhon* out of his experiences as a sojourning agent of Britain,¹³⁴ and if we take Zemka's view that the story pushes off from this reality into a fantastic space that nevertheless ultimately endorses colonialism, then *Erewhon* looks less like the novel, which was developing toward realism in the late nineteenth century, and more like the romance, which was being pushed toward new horizons of imagination.¹³⁵

I insist on situating *Erewhon* as a romance for two reasons. First, as a romance, imperialism is not merely a facet of *Erewhon*'s sociopolitical context, but the form and purpose of its communication, in the world circumscribed by Butler's words and in the world in which he published them. To say that Butler was writing romance is to say that his imaginary narrator was

¹³³ Sue Zemka, "Erewhon and the End of Utopian Humanism," *English Literary History* 69:2 (Summer 2002): 439-472.

¹³⁴ This idea took hold early in Butler criticism. For example, Harris wrote that "More than this, [Butler's] experiences in this new country supply a background of romantic adventure to the rest of his life. Yet to him, of course, there was very little romance about the New Zealand period; though to us, looking back to the earlier part of his career, there is a singular interest in picturing him on his run, Mesopotamia, busy with his sheep, yet still finding time to observe and record the natural conditions of the country. It was from these colonial days, too, that he got the nucleus round which *Erewhon* built itself up. Nothing less than all this was his New Zealand legacy." See John Frederick Harris, *Samuel Butler, Author of Erewhon: The Man and His Work* (London, England: G. Richards, 1916), 64.

¹³⁵ See, for example, Edwin Abbot's *Flatland: A Romance of Many Dimensions*. Lewis Carroll's *Alice* books are also arguably romances in this late-nineteenth-century sense.

communicating to his intended audience in terms inflected by imperial values, but also that Butler himself was deploying imperial values in communicating with Victorian readers, though exactly what Butler intended by this imperialism-inflected communication is still a matter of critical debate. Second, emphasizing the generic conventions of the romance leads to insights that clarify Butler's intervention in nineteenth-century science. One of the merits of Parrinder's reading is that it draws attention to what he refers to as "the narrative entry" into the story, which also happens to be the account of Higgs's geographical entry into the land of Erewhon. In this passage he sees the five-part structure of a "loose narrative formula" characteristic of late-nineteenth-century dystopian romance: Higgs's separation from his own society; his passage of a forbidden boundary; a kind of timelessness in a liminal space between his own society and Erewhon, and also the marvelousness of this liminal space; and an experience of death that leads to a rebirth-entry into Erewhon.¹³⁶

By contrast, I argue that the lifecycle we see is an evolutionary morphology, Butler's own way of expressing Haeckel's recapitulation theory, summed up in the now-famous dictum that "ontogeny recapitulates phylogeny." In *Erewhon*, Higgs's machinic ontogeny recapitulates British phylogeny. And it is clearly *British* phylogeny because Butler juxtaposed the machinic, which is to say the modern, Higgs with the non-machinic, which is to say the anti-modern, Erewhonians. By implication, machinic ontogeny is not essentially human; it is a function of some races' cultures, whereas other races instinctively abjure the mechanizing impulse. In *Erewhon*, this distinction delineates the British Higgs from Kahabuka and the Erewhonians.

Erewhon's Narrative Entry: A Morphology of the British Colonist

¹³⁶ Parrinder, "Entering Dystopia," 11.

In chapters one through five of *Erewhon*, the part of the story that Parrinder has referred to as its “narrative entry,” Higgs, Butler’s protagonist, functions as a morphology of the British colonist that includes not only is human body but his mechanical prostheses. In addition to the importance Parrinder has placed on this stretch of the text, there are several good reasons for reading Higgs this way. Harris has noted that in *Erewhon* Butler “emphasized the importance of the physical qualities of the race.”¹³⁷ In *Erewhon*, becoming ill or diseased are high crimes, and the *Erewhonians* are beautiful. The theorists whose work comprises “The Book of the Machines” both value the human body. The New Species Theorist advocates a kind of Luddism in the interest of human survival and flourishing, and the Prostheses Theorist sees machines as ingenious enhancements of the human form, despite the risk of bodily degradation represented by overreliance on machine labor.

External to the text of *Erewhon*, Butler’s engagement with Charles Darwin and Darwinian evolution also commends this reading. Peter Bowler has situated Butler’s thinking within late-nineteenth-century evolutionary discourse and sees him as reacting against Darwinism. According to Bowler, Butler’s primary objections to Darwinian evolution were that it foreclosed divine design and creaturely creativity. He was concerned with the inner lives of humans and animals, including consciousness but also instinct, which he saw as the result of habit engrained over time; all of this aligned him more closely with Jean-Baptiste de Lamarck. “Increasingly concerned to allow a sense of purpose in evolution, Butler saw Lamarckism as a means of retaining an indirect form of the design argument. Instead of designing species by miracles, God had transferred His creativity to living things, allowing them to be the agents of

¹³⁷ Harris, 72.

their own and their species' development."¹³⁸ As Butler gradually recognized Charles Darwin's unacknowledged indebtedness to the work of Erasmus Darwin and Lamarck, he became angry and took aim at Darwin himself, particularly in *Evolution, Old and New* (1879), to the extent that his attacks "succeeded in alienating him from the Darwinian community."¹³⁹

At this point in the history of evolutionary discourse, morphology was increasingly seen as a means of reconstructing phylogenies; this reconstruction held more promise of recreating the history of life than did Darwinism or Lamarckism, and thereby constituted a means of refining theories of how bodies evolve and new lifeforms emerge. As a morphology of the British colonist, the narrative entry renders Higgs as both the genetic descendant of a colonizing British race and a theory of the late-nineteenth-century embodiment of British imperialism. Higgs's survival-fitness derives from his user relationship with the world around him, his ability to construct and/or utilize other bodies, both human and nonhuman, in order to move through the world. Put differently, Butler's morphology of Higgs defines him as a survivor who develops by making and using tools, often from other living beings.

Erewhon begins with Higgs's curiosity about what lies beyond the range of mountains at the foot of which he works as a hired shepherd. He aims to acquire his own pastureland and asks Kahabuka, "an old native" and a fellow hand, about the land beyond the range. Kahabuka—Higgs and the other colonists call him 'Chowbok'—at first avoids the question, then, after being bribed with grog, tells a wordless tale in malevolent facial expressions and wild gestures, piquing Higgs's interest and prompting him to explore the mountains. It is shearing time, and until the work is done and he is free to explore, Higgs drops the matter and begins referring to Kahabuka

¹³⁸ Peter Bowler, *Evolution: The History of an Idea* (Berkeley, CA: University of California Press, 2014), 239.

¹³⁹ Bowler, *Evolution*, 239.

by his real name, “which gratified him greatly.” However, as they near the end of their shearing work, such respectfulness proves a sham when he conscripts Kahabuka for an excursion: “I thought it would be a good thing to take Chowbok with me; so I told him that I meant going to the nearer ranges for a few days’ prospecting, and that he was to come too.”¹⁴⁰ In using Kahabuka’s anglicized nickname here, Higgs gives his reader to know that he really sees Kahabuka as ‘Chowbok,’ a ‘native’ whose knowledge and body are available to him, a white colonist, for use. ‘Chowbok’ need not be taken seriously except where to do so will serve Higgs’s own ends.

Higgs also plans to use nonhuman animals in his excursion: “I bought an old pack-horse and pack-saddle, so that I might take plenty of provisions, and blankets, and a small tent. I was to ride and find fords over the river; Chowbok was to follow and lead the pack-horse, which would also carry him over the fords.”¹⁴¹ Although Kahabuka clearly has more information on the terrain that Higgs intends to explore, he is not dignified as a guide. Instead, Higgs reduces him to an appendage by seeing him as a hand, or as a second pair of hands, responsible for managing an animal that is needed to carry supplies. Kahabuka’s body is simply another cog in Higgs’s exploration-machine. It is therefore no surprise that Higgs’s description bespeaks a hierarchy: made to walk along with the pack-horse, Kahabuka travels down among the animals while Higgs himself rides above them. Nor is the going all that easy. Recalling their passage through a particularly treacherous gorge filled with a thundering river, Higgs writes, “There was that damp black smell of rocks covered with slimy vegetation, as near some huge waterfall where spray is ever rising. The air was clammy and cold. I cannot conceive how our horses managed

¹⁴⁰ Butler, *Erewhon*, 48.

¹⁴¹ Butler, *Erewhon*, 48.

to keep their footing, especially the one with the pack, and I dreaded the having to return almost as much as going forward.” Apparently Kahabuka’s footing is of no concern to Higgs, though “the gorge was narrow and precipitous” and the river “roared and thundered against rocks of many tons in weight.”¹⁴² Although they are both clearly at risk of slipping into the tumultuous river, Higgs is most concerned about the horses.

Higgs’s account ungenerously and hypocritically denigrates Kahabuka as “a great liar” and a deserter,¹⁴³ but their hard travel, not to mention the statues guarding the pass to Erewhon, which have terrified Kahabuka since before the excursion, explain the guide’s eventual departure. Higgs’s initial reaction is to denounce Kahabuka, but later, when he is hungry, wet, and cold, he realizes “how useful [‘Chowbok’] had been to me, and in how many ways I was the loser by his absence, having now to do all sorts of things for myself which he had hitherto done for me, and could do infinitely better than I could.”¹⁴⁴ In the absence of both Kahabuka and the horses, Higgs reflects, “I do not believe that any man could long retain his reason in such solitude, unless he had the companionship of animals. One begins doubting one’s own identity.”¹⁴⁵ Without another human or animal to tack onto his “identity,” his physical person, Higgs’s “reason”—in this case, his sense of the logic of hierarchy—erodes.

On foot, without his human and animal tools, Higgs must rely on his ability to use plants to continue his journey. By this point he has passed over a ridge and started to descend its far side in pursuit of “blue and distant plains” that he has glimpsed from the height. Between him and this promising land lies “an awful river, muddy and horribly angry, roaring over an immense

¹⁴² Butler, *Erewhon*, 51.

¹⁴³ Butler, *Erewhon*, 53.

¹⁴⁴ Butler, *Erewhon*, 63.

¹⁴⁵ Butler, *Erewhon*, 59.

river-bed.”¹⁴⁶ Higgs considers himself “an excellent swimmer,” but apparently not excellent enough to cross the river. He could still turn back, “but the hope of finding an immense tract of available sheep country (which I was determined that I would monopolise as far as I possibly could)” outweighs his concerns. “The more I thought, the more determined I became either to win fame and perhaps fortune, by entering upon this unknown world, or give up life in the attempt. In fact, I felt that life would be no longer valuable if I were to have seen so great a prize and refused to grasp at the possible profits therefrom.”¹⁴⁷ The logic of hierarchy that led him to objectify Kahabuka as a tool and value the sense of identity he gained from traveling with horses turns out to be the logic of empire, a rationality in which no life—not even his own—is as valuable as the fame and fortune that founding a new settlement promises. Using the environment around him to construct machines, however crude, is an essential aspect of pursuing this glory. Higgs realizes that his only chance of crossing the river is to make a raft, which “would be difficult to make, and not at all safe when it was made—not for one man in such a current.”¹⁴⁸

The lifecycle in *Erewhon*’s narrative entry evinces two evolutionary trajectories. First, Higgs’s tools are made from increasingly lower rungs on the Great Chain of Being. He begins by using a human, then a horse (i.e. a nonhuman animal), then plants. The logic of this trajectory leads to the use of minerals, i.e. of metal, and thus to machinery. We know Butler was thinking in these terms because in the 1901 edition of *Erewhon* he appended the treatises found in the Colleges of Unreason, adding to “The Book of the Machines,” which addresses the practice of

¹⁴⁶ Butler, *Erewhon*, 55.

¹⁴⁷ Butler, *Erewhon*, 57.

¹⁴⁸ Butler, *Erewhon*, 61-62.

making tools from minerals, positions on the rights of animals and plants. Across this trajectory Higgs's tool-making ability develops from the utilization of complex, ready-to-use tools toward simple materials that must be synthesized into the tools he requires: the cruder his materials, the more ingenuity he must demonstrate in constructing his machines. His growing ability to utilize all materials is a micro-study in the development of modern production.

This trajectory of tool-making ingenuity coincides with a second evolutionary trajectory along which Higgs's locomotion advances considerably. He begins by moving along the ground, then floats across the water, and eventually floats through the air—he is “one who can tack on a special train [or human, or horse, or raft, or balloon] to his identity.”¹⁴⁹ The ontogeny of Higgs's locomotive development recapitulates a British phylogeny, specifically a history of the habit of using other bodies, vehicles included, to extend Britain's presence across the globe. Riding a horse postures Higgs as a medieval knight and Kahabuka as his walking squire, minding his gear. Higgs's tendency to see other humans as tools erodes the distinction between non-Europeans and work animals, calling to mind the transatlantic slave trade in which Britain played such a central role through the Restoration period. And in making a raft, Higgs demonstrates the British maritime proclivity whence emerged the vaunted Royal Navy, the fundament of Britain's nineteenth-century empire.

Flight and the Modern Future

Bookended on one side by this lifecycle and on the other by Higgs's and Arowhena's escape in a balloon, “The Book of the Machines” was structurally central to Higgs's mechanical evolutionary development in *Erewhon* and was originally located at a point in the text that

¹⁴⁹ Butler, *Erewhon*, 225.

prompted the reader to consider the balloon escape in terms of Butler's Protheses Theory. In "tacking on" a succession of vehicles that steadily broaden the reach of his locomotion, Higgs embodies the Protheses Theory, which he learns from "The Book of the Machines" after finally entering Erewhon; and as the last word in "The Book of the Machines" before the account of Higgs's escape, the Protheses Theorist has overtly placed the mechanically adaptive human¹⁵⁰ in competition with the non-machinic humans of Erewhon. Erewhon, the society ordered according to the New Species Theory, has developed the habit of culling its machines lest they out-evolve its humans; but this habit of culling makes it ripe for colonization by Britain, a society whose machines are extending its military and economic presence across ever-greater distances while also enriching its ability to use even the crudest of resources—including the Erewhonians' very bodies.

The apex of Higgs's vehicular development is the balloon in which he and Arowhena escape. Butler, like many of his contemporaries, including Verne, imagined flight as one function of machines from the modern future, which is one of the most romantic aspects of the late-nineteenth-century scientific romance. Here again, *Erewhon* calls to mind—and, I would add, so does any other text that imagines future machines—Ker's description of the romance as engaging in "experiments of the imagination,"¹⁵¹ as well as Beer's recognition that "Romance is always concerned with the fulfillment of desires" and "it is usually acutely fashionable, cast in the exact mould of an age's sensibility."¹⁵² In Butler's case, the "experiment" was how to

¹⁵⁰ One might just as aptly refer to this as the *proto-posthuman*, the human whose adaptivity suggests that he is always-already more-than-human, or human in a machinic way that abrogates the Renaissance human construed as the measure of all things, but in a time before the work of Donna Haraway and N. Katherine Hayles.

¹⁵¹ Quoted above in n. 13.

¹⁵² Beer, 12.

imagine the biological implications of humans' development of socially revolutionary machines, such as Higgs's balloon in Erewhon.

One of the biological implications is Higgs's escape from Erewhon with Arowhena, which implies the perpetuation of his genes and also the strength of any children they have, owing to Arowhena's strong constitution and Higgs's guile. This became fodder for Butler's *Erewhon Revisited*, which was published in 1901 and which lies beyond the scope of my argument here. Another implication is the conclusion Higgs reaches about the Erewhonians, which leads to the sales pitch at the story's end: the Erewhonians are ripe for colonization. Higgs's account of his escape begins with a clear acknowledgement of his and the Erewhonians' respective roles in it. Tellingly, he begins by saying that, amid his work to translate "The Book of the Machines," "I was also laying matters in train for my escape with Arowhena"¹⁵³; I read "in train" as a pun, a flash of Butler's wit which blitzes past the railway locomotive between the accounts of Higgs's raft and his balloon. But this line also informs us that Higgs's role in his escape is the role of a strategist, not of a laborer; he is exulting in having manipulated the Erewhonians into laboring for him. To achieve this, he gains the confidence of Erewhon's Queen, piques her curiosity about seeing a balloon, engages in a bit of marketing when he points out to her "that no complicated machinery would be wanted,"¹⁵⁴ and gets her to obtain an order from the King for all the labor and materials needed. The balloon is built, Arowhena is concealed in its basket, and, just before those who would prevent her marriage to Higgs apprehend them, the couple lifts off.

¹⁵³ Butler, *Erewhon*, 243.

¹⁵⁴ Butler, *Erewhon*, 243.

I want to address a second biological implication of Higgs's balloon in a roundabout way, by returning to Zemka's observation that "*Erewhon* narrates a world which fulfills the ideological fantasy of settler colonialism," and considering it at two levels: within the textual world of *Erewhon*, and within the world of Victorian England, which I will treat in the following section. Within the world of *Erewhon*, the ideological fantasy of settler colonialism is Higgs's fantasy, and the balloon is an instrument for fulfilling it. The balloon, once constructed, becomes, to borrow an apt phrase from Neill, an "engine that that draws remote regions of the empire together," in this case, the imperial center of London and Erewhon, which Higgs would like to colonize. The balloon reconnects Higgs, and Arowhena with him, to the imperial networks that Neill has read in *Erewhon*, by landing the couple in the path of an Italian ship sailing from Callao, the port of Lima, Peru, to Genoa. This is a line, essentially a highway, between a New World colony and a major European port, and landing on it puts Higgs and Arowhena well on their way back to London.

The voyage to London gives Higgs ample time to plot his return, and he thinks about Erewhon as a geographic discovery; aware that it is not enough to have discovered it first, he realizes that he must also be the first to divulge its existence to those in London, for they are the arbiters of the official story. A ship is spotted, a freighter carrying wool from Melbourne to London. Higgs and Arowhena convince the Italian captain to transfer them to the British vessel, but they do so amid rough weather that prevents anyone from explaining that they were found in a downed balloon, leaving Higgs the opportunity to spin their story as advantageously as possible. In the interest of retaining the secret of Erewhon, he claims that they are survivors of a lost pleasure cruise and so changes Arowhena's identity, explains her exotic appearance, and seizes the privileges of class by identifying her as a Peruvian lady; he gains his own share in

these privileges when he and Arowhena are married aboard the ship. By the time Arowhena arrives in London she has been racially, culturally, socioeconomically, and religiously redefined in terms that are familiar and respectable enough to gain for Higgs an audience for his business proposal to return and transport the Erewhonians to Queensland as sugar plantation laborers, but also to be converted to Christianity. In all of this, Higgs uses Arowhena as a tool to realize his fantasy of officially discovering a colony, and all of the rights and accolades associated therewith: wealth, respectability, perhaps a noble title or the honor of having a place named after him.

Higgs fails to acknowledge in any meaningful way—and may even be read as intentionally occluding—that if his personal dreams are realized it will mean the biological disruption of a people group that has been secluded for centuries. Higgs’s plan to transport the Erewhonians to Queensland leaves open the question of their susceptibility to intermarriage or, apart from marriage altogether, their sexual subjugation by the populace of Britain’s erstwhile penal colony under the auspices of an unclear working arrangement that could be indentured servitude or even enslavement. Higgs’s exploits with Arowhena are proof of this susceptibility, and the lack of clarity on the arrangement into which he proposes to induce the Erewhonians, coupled with his readiness to impress them by force, indicates that Higgs is ultimately unconcerned with their wellbeing, not merely socially, but biologically.

Butler, In All Seriousness

In addition to Higgs’s own fantasies of colonization in the story, *Erewhon* fulfilled the ideological fantasy of colonialism in the real world, if not for Butler, at least for his Victorian readers. Based on the reading I have offered, “The Book of the Machines” was important to Butler. He situated it at *Erewhon*’s climax, and it explains Higgs’s development as a protagonist,

how he got to Erewhon, and how he escaped to tell the tale. As such, “The Book of the Machines” defines *Erewhon*’s central themes. Moreover, Butler’s satire complicates critical claims about his intentions; my focus on “The Book of the Machines” is an attempt to address this problem because it emphasizes the part of the book about which Butler was likely to have been serious, having developed it from the editorials he had published in New Zealand.

Clara Stillman recounts an important piece of Butler’s biography from 1869, when he was returning from a months-long vacation on the Continent he had taken to renew his health:

At Venice, on his way back to England, he met an elderly Russian Lady, a quiet, plain, intelligent person who found him interesting and led him on to talk about himself. She perceived that his powers far outran his achievements.

“Et maintenant, monsieur, vous allez créer,” she said as she bade him good-bye, meaning, says Butler, that he had been looking long enough at other people’s work and should now do something of his own.¹⁵⁵

She goes on to point out that this marked the beginning of a fifteen-year period in which Butler wrote his most important works, including *Erewhon*, which came first. *Erewhon*’s structure prior to the 1901 revisions suggests that at as Butler began by returning to the pieces of his writing he was most serious about, his editorials on machine evolution, and worked them into what would eventually become *Erewhon*: Higgs’s very embodiment evolved out of those editorials.

Butler’s theories of machine evolution grew out of a second matter about which he was deeply serious, to the point of being increasingly antagonistic: the inadequacies of Darwinian evolutionary theory. Above I have noted Butler’s increasingly antagonistic relationship with Darwin and the Darwinists, which coincided with a Lamarckian reaction against Darwinism around the time Butler was writing. Much of this reaction stemmed from the practice of

¹⁵⁵ Clara Gruening Stillman, *Samuel Butler, a Mid-Victorian Modern* (New York, NY: The Viking Press, 1932), 82.

morphology, which was aimed at studying the effects of an organism's habits on its ontogeny, which in turn offered clues to its phylogeny. Given Butler's antipathy toward Darwin, his concern that evolutionary theory leave room for purposive development and individual decision, and his seriousness about his theories on machine evolution, the reading I have offered here focuses on matters which Butler would have had no interest in satirizing. The problem this raises, then, is that Butler was serious about his theories of machine evolution and he used them to describe Higgs's development, and these are the pieces of *Erewhon* that generate the effect of intercultural competition between Britain and Erewhon, which in turn occasions Higgs's imperialist business plan. If Butler was serious about machine evolution and about writing his protagonist morphologically in concert with a broader reaction against a thinker he disliked (Darwin), it is difficult to conclude that he was not also serious—or, at the very least, blandly indifferent—to the imperialism that logically followed.

However, even granting that Butler's satire makes *Erewhon* too slippery to be sure about his political views, we still have to consider the way it might have been (mis)read by Victorian readers. Butler's relentless search for a synthesis of the antitheses of his contemporaries is largely to blame.¹⁵⁶ "I am not responsible for the interpretations of my readers," Butler wrote in the preface to *The Fair Haven*. "It is only natural that the same work should present a very different aspect according as it is approached from the one side or the other. There is only one way out of it—that the readers should kindly interpret according to his own fancies."¹⁵⁷ In

¹⁵⁶ Code champions this view. See Murray Code, "How Right was Samuel Butler About Evolution? Part II: Why Evolution is Really a Problem for the Humanities," *Cosmos and History: The Journal of Natural and Social Philosophy* 10:2 (2014): 92-120, particularly pg. 94.

¹⁵⁷ Samuel Butler (as John Pickard Owen), *The Fair Haven: A Work in Defence of the Miraculous Element in Our Lord's Ministry Upon Earth, Both as Against Rationalistic Impugners and Certain Orthodox Defenders* (London, England: Trübner, 1873), viii.

addition to shifting onto his readers the onus of interpreting his works, Butler was untroubled by any sense of responsibility for writing clearly. Stillman has pointed out that Butler's style often confused his readers:

He was master of a brilliant style, a multiple magic of knowledge, imagination and wit, and a rapier irony, flexible, soft gleaming and deadly; and had more and newer things to say than any other man of his generation. But his views were unorthodox and unpopular, and the more he wrote the more he shocked an increasing number of people in an increasing number of groups until, intellectually, he had nowhere to lay his head. He puzzled them, too, with his subtle and various presentations of his monstrous ideas so that they could not tell when he was in jest, when in earnest.

And in Victorian England, "this [was] one of the unforgivable sins."¹⁵⁸

The total picture is one in which *Erewhon* did not speak for itself and Butler either refused to speak for it or foreclosed the human interactions that could have brought clarity to it. Under such circumstances, how would Victorian readers have read *Erewhon*? "What may reader or reviewer do with so slippery a customer, but sigh, sit down, and stick staunchly to surmises?" asked one reviewer.¹⁵⁹ Another reviewer wrote that "the effect of the whole [of *Erewhon*] is disappointing, where it is not unintelligible."¹⁶⁰ Reviews from the 1870s generally perceived attacks on British social conventions and institutions, particularly on Christianity and on the Church, and responded in kind: "Admitting the singular ability of this book, we absolutely refuse to give it a lofty place in the literature of our country. It is caustic, amusing, at times powerful and eloquent; but it answers no other greater purpose. Telling us a deal with which every

¹⁵⁸ Stillman, 83-84.

¹⁵⁹ No Author, "Erewhon," *Victoria Magazine* 20 (November 1872 – April 1873): 53-63.

¹⁶⁰ No Author, "Erewhon; or, Over the Range," *The British Quarterly Review* 56 (July and October, 1872): 261-263.

thinking member of the community is quite familiar, unsparingly ventilating the private thoughts and convictions of thousands, how does it practically benefit us?"¹⁶¹

One point on which Victorian readers read Butler approvingly, though, was on his treatment of colonialism. To some extent, this was a fascination with scientific discovery and exultation in the expansion of the Empire: "One of the most skillful parts of the book is the account of the adventures of the colonist of the fable in his discovery of the land of Erewhon, of the interview with the Indian Chowbok [*sic*]... of the three weeks exploring with Chowbok, by which he reaches the foot of the pass, and his desertion by the terrified Chowbok before he attempts it; of his own dangers on the journey, and of his ultimate success."¹⁶² However, in some reviews this fascination was clearly inflected by a Nietzschean will to power. For example, one contributor to a journal of science and technology called *Erewhon* "the strangest, and probably the most repulsive, Utopia ever written. So repulsive, indeed, that were the 'Erewhonians' actual begins a crusade for their extirpation would seem not merely legitimate but imperative."¹⁶³ This explains the prolific Victorian writer and moral activist Frances Power Cobbe's invective in *The Scientific Spirit of the Age: in Victorian England* "There may be discovered a *bacilli* of Hatred, Covetousness, and Lust, respectively responsible for Murder, Theft, and Adultery. Already hypocrisy is a recognized form of Hysteria. The state of opinion

¹⁶¹ No Author, "Erewhon," 57.

¹⁶² No Author, "The New Gulliver," *The Spectator* 45 (20 April 1872): 492-494.

¹⁶³ No Author, "Selections from Previous Works, with Remarks on Mr. G. J. Romanes's " *Mental Evolution in Animals,*" and a Psalm of Montreal. By Samuel Butler. London : Trübner and Co." *The Journal of Science and Annals of Astronomy, Biology, Geology, Industrial Arts, Manufactures, and Technology* 21 (1884): 286-290.

in ‘Erewhon’ may be hopefully looked for in England, when the Scientific Spirit altogether prevails.”¹⁶⁴

Conclusion

While Cobbe’s moralizing accusation comes off as reactionarily conservative, C. Lloyd Morgan’s *Springs of Conduct: An Essay on Evolution* treated *Erewhon* as an influence on engineers’ efforts to envision future machines, albeit with some humor that comes off as Morgan’s attempt to avoid any loss of respect as a scientist for referring to an obviously non-scientific text.¹⁶⁵ Morgan defined machine evolution as “not the multiplication of similar structures, but the production of one more complex structure which shall do the work of many,” and cited as an example the propellers of trans-Atlantic steamships, an application that explains the appeal of Verne’s imaginary ships in the English-speaking world; I will address that in the following chapter.

Morgan’s final paragraph is worth quoting at length because it epitomizes the milieu in which the mechanimal, as a technological vision, coalesced. This was a cultural and historical context marked by a widespread belief in human labor, science, and technology, a context which generally accepted structural development as natural and lauded anything—including the politics of empire—that would facilitate progress, regardless of its impact on nonmodern others.

Finally, let it be clearly remembered that the evolution of machines is but the sign and outward manifestation of the evolution of certain activities of that highest known product of organic evolution, man. From the subjective or ejective point of view, it testifies to the evolution of mind; from the physiological point of view, it testifies to the evolution of those multitudinous muscular adjustments which enable man to gain the mastery over the materials at his command, not only directly, but yet more indirectly through tools and

¹⁶⁴ Frances Power Cobbe, *The Scientific Spirit of the Age, and Other Pleas and Discussions* (Boston, MA: G. H. Ellis, 1888), 13.

¹⁶⁵ C. Lloyd Morgan, *Springs of Conduct: An Essay on Evolution* (London, England: Kegan Paul, Trench & Co., 1885), 152-160.

mechanical appliances; from the morphological point of view, it testifies to the evolution of certain invisible structures within that most complex product of evolution, the human brain. Thus the evolution of machines is but a part of that general and far-reaching process of evolution to which not only man, his structure and activities, not only the whole organic world, but the entire realm of Nature, bears abundant and unimpeachable testimony.¹⁶⁶

¹⁶⁶ Morgan, 160.

Chapter II: Jules Verne, Designer of the Mechanimal Body

What we call Man's power over Nature turns out to be a power exercised by some men over other men with Nature as its instrument.

C. S. Lewis, *The Abolition of Man*

Jules Verne's oeuvre addressed a critical gap in Butler's "The Book of the Machines":

Here followed a very long and untranslatable digression about the different races and families of the then existing machines. The writer attempted to support his theory by pointing out the similarities existing between many machines of a widely different character, which served to show descent from a common ancestor. He divided machines into their genera, sub-genera, species, varieties, sub-varieties, and so forth. He proved the existence of connecting links between machines that seemed to have very little in common, and showed that many more such links had existed, but had now perished. He pointed out tendencies to reversion, and the presence of rudimentary organs which existed in many machines feebly developed and perfectly useless, yet serving to mark descent from an ancestor to whom the function was actually useful.¹⁶⁷

Where Butler denigrated the animalization of machines as "puerile" and a taxonomy of machines as "a digression," Verne wrote his life's work, ensuring his influence on science fiction, in all its forms, and on the inventors of modern vehicles.

One of Verne's biographers, Marguerite Alotte de la Füye, observed that "if one had to classify his hundred and four books—or, at least, those in which his inspiration is given full reign—according to their nature and contents, it would not be unfair to group them under these four headings: novels terrestrial, aerial, aquatic and igneous."¹⁶⁸ In evolutionary terms, Verne's vehicles were niches within these environments designed to facilitate the survival of his human characters, but also means of locomotion that allowed his characters to pass through the elements with ease. Hetzel, Verne's editor, published sixty-eight of his stories as a series titled *Les Voyages Extraordinaires*, marketing Verne's

¹⁶⁷ Butler, *Erewhon*, 214.

¹⁶⁸ Marguerite Alotte de la Füye, *Jules Verne*, trans. Erik de Mauny (London, England: Staples Press Limited, 1954), 109. On the four elements in Verne's work, de la Füye's thirteenth chapter is an insightful resource. Also, it's worth noting that this view of the world was not an arbitrary choice on Verne's part, but a common perception of the structure of material reality in the early nineteenth century, in England as well as in France. See, for example, John Barclay, *An Inquiry into the Opinions, Ancient and Modern, Concerning Life and Organization* (Edinburgh, Scotland: Bell & Bradfute, 1822).

books as excursions, explorations, journeys into the wild unknown. Such adventures required some mode of transportation, and Verne's habit of imagining vehicles fit for traversing the elements constituted the sort of machine taxonomy that Butler elided from "The Book of the Machines": Verne's machines are, to adapt Füye's wording, machines terrestrial, aerial, aquatic, and subterranean.

In this chapter I read Verne as the designer of the mechanimal body, a view that logically follows from Patrick Parrinder's observation that "Verne's fiction is a logical extension of the engineering mentality of the Age of Steam."¹⁶⁹ For a long time, the mechanimal was a vehicle in the sense that we commonly use the term today, a carrier of human passengers. Only recently, as human control has become possible even from outside of the mechanimal body, has the vision shifted to include biorobots. If the vehicle has recently begun to take animal form it is because animals were the first vehicles, a fact that Verne played on time and again in his writing. In *The Adventures of Captain Hatteras*, the first of *Les Voyages Extraordinaires*, he described Captain Hatteras's ship, the *Forward*, as "tacking skillfully through the packs and icebergs, thanks to her steam [engine], that obedient force unavailable to so many navigators of the polar seas... it was almost as if she recognized an experienced master's hand and, like a horse with a skillful rider, was obeying her captain's thoughts."¹⁷⁰ Here he updated the romance tradition for a modern age, replacing the medieval knight's horse with the modern explorer's ship; it should therefore come as no surprise that Verne described ships in bodily terms. As he noted elsewhere in *Hatteras*, "For a thinker, a dreamer, a philosopher, nothing is as moving as a ship about to sail; one's imagination gladly follows her fights against the waves, her struggles with the wind, her perilous course that does not always end up in port. Should an unusual feature emerge, the ship may take on a fantastic form, even to minds resistant to the imagination."¹⁷¹

¹⁶⁹ Patrick Parrinder, *Science Fiction: Its Criticism and Teaching* (London, England: Methuen, 1980), 7.

¹⁷⁰ Jules Verne, *The Adventures of Captain Hatteras*, ed. and trans. William Butcher (Oxford, England: Oxford University Press, 2005), 80.

¹⁷¹ Verne, *Hatteras*, 8.

The vehicles Verne designed were not literary, ethereal vehicles, but realistic vehicles patterned after the bodies and replicating the movements of nonhuman animals. His design thinking was influenced by what might appear at first to be a disparate assemblage of unrelated artifacts. Aesthetically, his designs were influenced by the *nef*, a ship-shaped type of Renaissance wonder fabricated from the shells of sea creatures. Scientifically, his ships were designed around the *hélice*, a prototype of the propeller derived from early-nineteenth-century animal locomotion research in which the bodies of birds and fish were dissected and dismembered in order to discover their machinations. The *hélice* was devised to approximate the movements of animal bodies' appendages so that animal locomotion could be replicated mechanically. And technologically, Verne's ships served similar purposes to the British Royal Navy's polar exploration ships, which he iteratively redesigned throughout *Les Voyages Extraordinaires*, casting a vision of future vehicles that later inspired Octave Chanute as he worked to develop a heavier-than-air flying machine, Igor Sikorsky as he invented the helicopter, and Norbert Wiener as he developed the cybernetic theory fundamental to twenty-first-century biorobotics.

Here I focus on Captain Nemo's biomimetic submarine, the *Nautilus*, in Verne's story *Twenty Thousand Leagues Under the Seas*; its importance becomes clear if we first trace the arc of Verne's design thinking through *Les Voyages Extraordinaires*. In *The Adventures of Captain Hatteras* (1863) he imagined a British expedition to the North Pole, which is plagued by all of the problems described in British polar explorers' accounts. *Hatteras* set the tone for many of the later installments in the series. Nemo's submarine in *Twenty Thousand Leagues* (1869) is the first instance of the mechanimal and it marks the beginning of a series of Vernian attempts to redesign ships in an effort to mitigate known problems with nineteenth-century exploration vessels, problems he came to understand while researching *Hatteras*. Twenty years after writing *Twenty Thousand Leagues*, Verne inverted the horizon and rewrote the story, this time designing a flying ship, Robur's aeronef *Albatross* in *Robur the Conqueror* (1886). And when Robur returned in *The Master of the World* (1902), he was piloting the *Terror* an omnilocomotive, a vehicle that could travel on land or on water, under water, and through the air. Were we to perform a Butlerian taxonomic analysis of the arc of Verne's design thinking that passes through

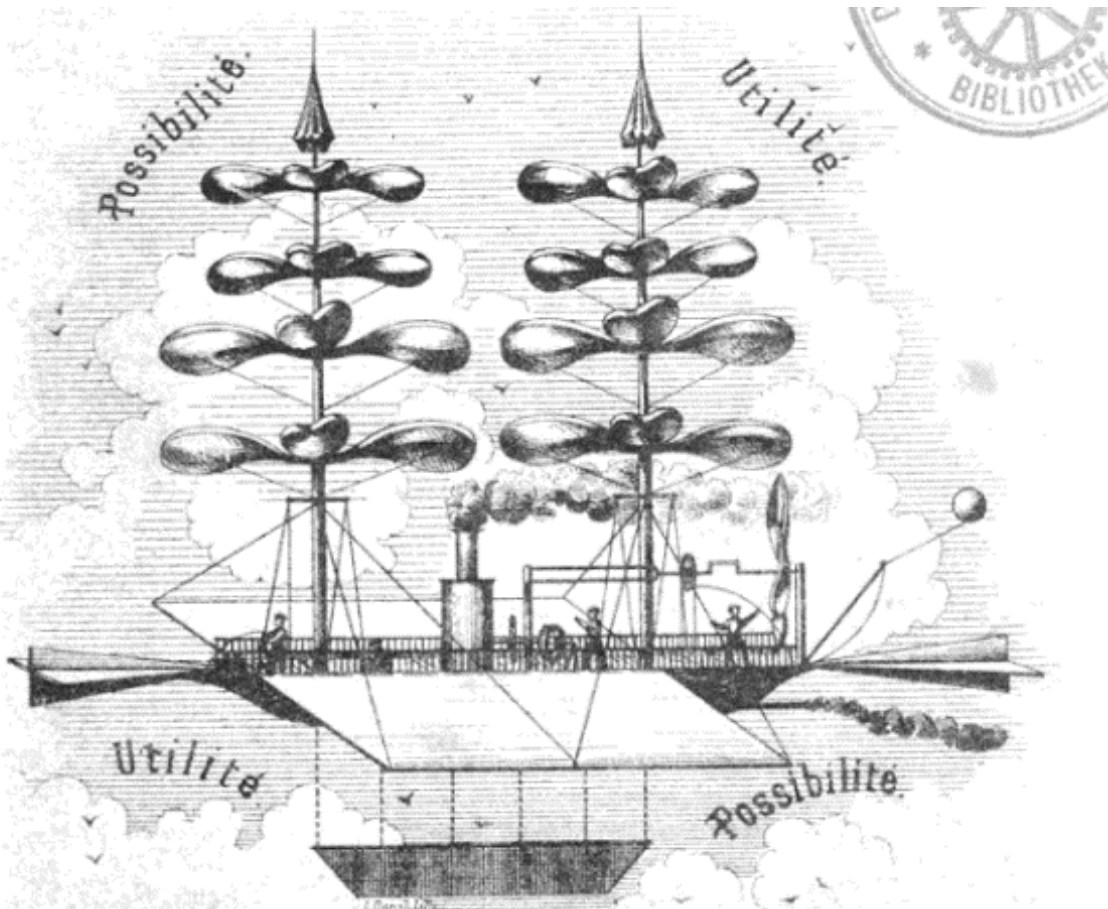


Figure 1: The aeronef as d'Amecourt imagined it.

Les Voyages Extraordinaires, we would conclude that Verne saw the ship as the common ancestor of all vehicles, including Nemo's submarine, Robur's aeronef, and Robur's omnilocomotive.

To some, particularly readers from art, design, and engineering fields, it may seem odd to refer to Verne as a designer. After all, designers create models, mock-ups, and schematics. Certainly, our contemporary concept of a designer is closely associated with what a designer produces—designs—and the textual forms that they most commonly take, and the camera, the screen, and the computer have profoundly slanted our concept of designs, designers, and designers' work toward visualizations. However, when I call Verne "a designer" I mean it in the sense Don Norman uses it in his monolithic book, *The Design of Everyday Things*. According to Norman, design is "concerned with how things a concern that can be expressed in a variety of media, including texts beyond the graphics-rich sorts of text

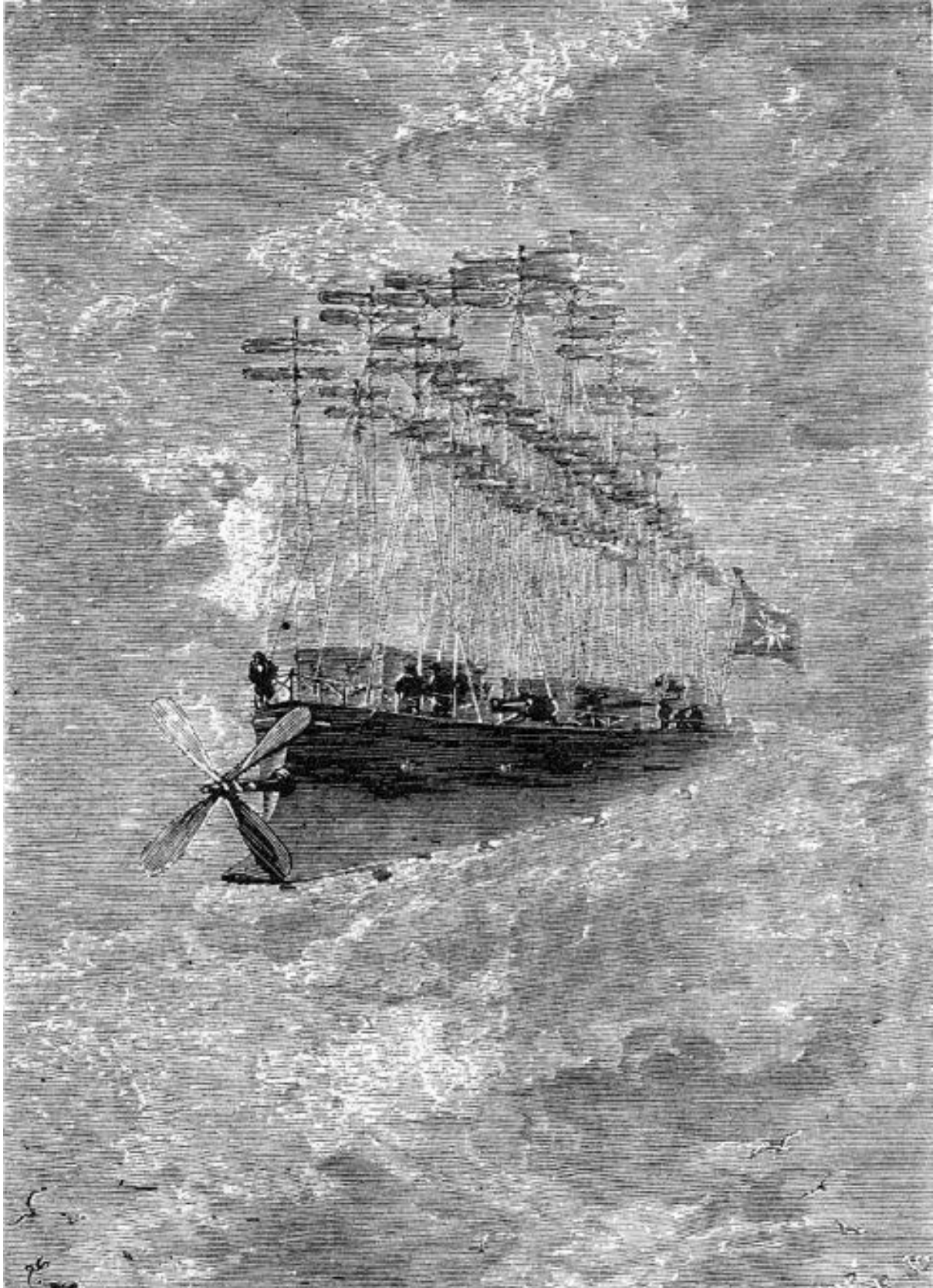


Figure 2: Verne's aeronef Albatross as depicted in Robur-le-conquérant

one might associate with contemporary design. Since Norman also argues that “Great designers produce pleasurable experiences,” and that “Experience is critical, for it determines how fondly people remember their interactions,”¹⁷² I would argue that the pleasurable imaginary experiences literary genres afford make them valuable design tools. Owing to the romance’s tendency to produce pleasure, Verne’s “scientific romances”¹⁷³ were paradigm cases of pleasure-producing design through literature.

Much of the pleasure in Verne’s stories comes from the experience of discovery and understanding he created for his readers, experiences that Norman argues are essential to good design.¹⁷⁴ In the introduction I have described the mechanimal as a literary trope, an extension of the wonder trope found in older romances; the mechanimal trope emerged as the romance came under the influence of science. Defined this way, the *Nautilus* is the earliest mechanimal, and it affords Verne’s characters and readers an experience of discovery and understanding that leads to the pleasure of adventure. For this reason, I mark the mechanimal body’s historic emergence in the scientific romance at this passage from *Twenty Thousand Leagues*:

“The thing in question, port astern!”
Everyone looked in the direction indicated.

About a mile and a half from the frigate, a long black body emerged about three feet from the waves. Its tail was beating violently and produced a considerable swell in the water. Never had a tail hit the water with such force. An enormous wake of dazzling whiteness marked the course of the animal as it described a long curve.¹⁷⁵

Here Verne sets up the experience of discovery and understanding by deploying an animal vocabulary: “the thing in question” is a body with a tail, and it is “animal” in the sense that it is self-moving, like the biological creatures that inhabit the wilds of our planet. At the time Verne was writing, a time before *National Geographic* and documentaries like *Animal Planet* and *Planet Earth*, those wilds

¹⁷² Norman, 10.

¹⁷³ Marie Belloc, “Jules Verne at Home,” *The Jules Verne Companion*, ed. Peter Haining (London, England: Souvenir Press, 1978), 21.

¹⁷⁴ Norman, 3. Emphasis here is Norman’s.

¹⁷⁵ Jules Verne, *Twenty Thousand Leagues Under the Seas*, ed. William Butcher (Oxford, England: Oxford University Press, 2009), 36.

were much larger and the creatures in them far less understood. Mocha Dick, the white whale made famous by Herman Melville's *Moby-Dick*, had been encountered in 1839, and it was not until 1857 that Japetus Steenstrup confirmed the existence of *architeuthis dux*, the giant squid, a natural explanation for the legendary Kraken.¹⁷⁶ With these recent discoveries in mind, Verne's first readers would have understood his obsessively taxonomizing protagonist, Pierre Aronnax, a renowned French anatomist, as he struggles to classify "the thing in question" based on a brief glimpse of its physical characteristics and on what he can surmise about its presence in the middle of the Pacific Ocean.

I have described the *Nautilus* and the trope that issues from it as "mechanimal" for two reasons. First, in the passage above Verne deployed what modern designers call a *skeuomorph*, a design in which old, familiar ideas have been incorporated in ways that shape the user's interaction with it, even though the design is for something new and perhaps radically different from anything the user has experienced previously. The word "mechanimal" reflects Verne's skeuomorphic deployment of multiple "conceptual models" that overlap on the same design. Norman defines a conceptual model as "an explanation, usually highly simplified, of how something works"¹⁷⁷; this explains how Verne could be designing through literature, rather than through other genres of writing, e.g. blueprints or schematics, commonly associated with design. Verne begins *Twenty Thousand Leagues* by describing "the thing in question" with the conceptual model of animality. When the thing begins attacking passenger ships with its horn, the governments of modern nations seek expert opinions on kind of creature it could be. Aronnax believes it is a large cetacean, perhaps a giant narwhal. He and his butler Conseil happen to be in New York and are offered the opportunity to join the *U.S.S. Abraham Lincoln* on a government-sanctioned hunt for the creature. Aboard the *Lincoln* they meet Ned Land, a Canadian harpooner who hopes to deal the

¹⁷⁶ Throughout the 1860s, Europe's scientific journals reported on the research published by Japetus Steenstrup, a Danish anatomist who proved the existence of the giant squid (*architeuthis dux*) in 1857. A brief HathiTrust search indicates that reports of Steenstrup's research were published in French as early as 1861 and continued to be published throughout the 1860s and 1870s, the very years during which *Twenty Thousand Leagues* was written and published.

¹⁷⁷ Norman, 26.

creature's death blow. After the sighting quoted above, the three are thrown overboard and find themselves riding on the creature's back.

The second reason I named the trope the “mechanimal” is that the word, as a symbol, introduces an experience of discovery and understanding similar to what Verne created in this encounter with “the thing in question. “Mechanimal” looks familiar—it is easily mistaken for “mechanical”—but upon closer inspection, it is not what it appeared to be; its surface seems to speak for itself, but we are not sure. Norman notes that “Simplified [conceptual] models are valuable only as long as the assumptions that support them hold true,”¹⁷⁸ and *Twenty Thousand Leagues* is now so famous it is hardly spoiling the story to say that Aronnax's ‘giant narwhal’ turns out to be a submarine. Now, in a time after *The Hunt for Red October* and similar stories, submarines are among the usual suspects for strange underwater phenomena glimpsed from a ship: history has broken Verne's spell. However, when read from the perspective of the nineteenth century, the *Nautilus*, as a real vehicular possibility, is a wonder. The wonder it evokes results from its subversion of the reader's expectation that in an age of astounding ichthyological discoveries this is a sea monster story like *Moby-Dick*, maybe one that features an even bigger, scarier leviathan like *architeuthis dux*. From this we can see that, by deploying both animality and mechanicity, Verne also deployed the conceptual model of wonder, here a function of the discovery that what readers might originally have believed to be an animal is actually a machine.

In rethinking Verne as a ship designer, I focus on these three conceptual models—animality, mechanicity, and wonder—because they offer new answers to three important questions that have already been posed by Verne scholars. First, what ships influenced Verne as he thought about ship design? Second, what vehicular designs did Verne influence? And third, what does this history of influence tell us about the mechanimal? As Neil Postman observed, “the uses made of any technology are largely determined by the structure of the technology itself—that is, its functions follow from its form.”¹⁷⁹ To the

¹⁷⁸ Norman, 26.

¹⁷⁹ Neil Postman, *Technopoly: The Surrender of Culture to Technology* (New York, NY: Alfred A. Knopf, 1992), 7.

extent that the mechanical trope was a means of envisioning the designs of future vehicles, the question of which past vehicles influenced its form matters considerably because the purposes behind the designs of those past vehicles are likely to have worked their way into the designs of the vehicles Verne's stories inspired. To the extent that those purposes were informed by imperial agendas, the future vehicles the mechanical trope envisions are really imperial tools through which the empires of nineteenth-century Europe colonized the modern world of the twentieth century as Verne's earliest readers grew up and helped develop modern vehicles. Reading Verne as a designer therefore accounts for the fact that his stories were frequently marketed as "boys' literature"; but rather than denigrating their literary value on these grounds, I insist that Verne's design thinking influenced a future generation of engineers whose work profoundly shaped the modern world.

Plot Summary: *Twenty Thousand Leagues*

*Twenty Thousand Leagues*¹⁸⁰ is famous; nevertheless, a plot summary is in order. I have already mentioned the story's opening in which a mysterious creature, thought to be a large narwhal, has been sinking the ships of modern countries; I have also recounted the *Abraham Lincoln's* voyage in search of the creature, and the fact that Verne's protagonist, Pierre Aronnax, his butler Conseil, and their shipmate Ned Land, are thrown overboard while engaging it somewhere in the Pacific Ocean. Just as they are about to drown, the creature surfaces beneath them. The moment of wondrous discovery, when the conceptual model of animality turns out to overlap the conceptual model of mechanicity, occurs when Land exclaims, "This beast is made of steel plate!"¹⁸¹ The creature, "the monster, the natural occurrence which had puzzled the entire scientific world... constituted a still greater marvel—a man-made

¹⁸⁰ Aside from numerous translations, editions, and republications, the story has been remade once as a musical, twice as a play, five times as a radio broadcast, twelve times as a movie (either live-action or animated), seven times as a television series, six times as an audio book, once as a musical album, at least once as a video game, and once as a ride at Walt Disney World's Magic Kingdom. Moreover, of some thirty-six remakes, ten have occurred since 2000, making it hard to believe one can live in the U.S. in the twenty-first-century and not have some familiarity with the story.

¹⁸¹ Verne, *Twenty Thousand Leagues*, 45.

phenomenon”; Aronnax calls it “a species of submarine boat, with the shape of a massive steel fish.”¹⁸²

Soon a hatch opens and the three are taken aboard.

The submarine’s captain, Nemo, Latin for “no man,” bids them welcome but offers them an ultimatum: since they have penetrated the secret of his existence, they may go free aboard the ship but must consent to be restricted to their quarters when he orders it, lest they discover anything about the ship he does not want them to know; the alternative is that he will return them to the sea. Following this ‘agreement,’ the possibility of an accidental discovery of something illicit generates suspense throughout the remainder of the story. Below I focus on passages that come after this pact, passages in which Nemo explains the *Nautilus*—that is his ship’s name—and its workings. It is powered by electricity, which for Verne seems to have been an almost-magical power, for it fuels the locomotion of many of his machines, making them seem more animal than would steam power or the internal combustion engine.

Under Nemo’s command, the *Nautilus* sets off on an adventurous circumnavigation of the globe. It passes through Polynesia, where it runs aground on a shell deposit until the tides come in; it sails past India and up the Red Sea, where Nemo reveals a subaquatic tunnel that communicates with the Mediterranean Sea; it passes the wrecks of Spanish gold ships in Vigo Bay, whence come Nemo’s fortune, which he uses to fund revolutions against empires, and the ruins of Atlantis. From there, it sails south to Nemo’s secret grotto in the Canary Islands, a coal mine in an extinct volcano where he makes sodium for the *Nautilus*’s batteries, and then on to Antarctica. It passes beneath the Antarctic Pack and surfaces near the South Pole, on which Nemo, in his most imperialist gesture, plants his black banner. On the return from the pole the submarine is nearly crushed beneath an iceberg, saved only by its biomorphic shape and ingenious machinery. At long last the dire secret is revealed: Nemo is out for revenge and is using the *Nautilus* to sink ships from the European nations he blames for the loss of his family in an Eastern European war. (The politics are Vague because Hetzel, Verne’s editor, feared the repercussions of too overt a statement on world events.) Nemo attacks a searching man-o-war and flees northward with

¹⁸² Verne, *Twenty Thousand Leagues*, 45.

Europe's navies in pursuit. Just as he sails the *Nautilus* into the maelstrom off Lofoten, Norway, Aronnax and his companions manage to escape but Aronnax is knocked unconscious in the process, which explains away the sketchy account of how escape was possible. The story reads as Aronnax's retrospect, written from Norway, "the faithful narration of an incredible expedition through an [aquatic] element inaccessible to man, although progress will open it up one day."¹⁸³

From Aronnax's account, the fate of the *Nautilus* is unclear. It went down the maelstrom, but it is a submarine and can move underwater. Wonder is the only panacea for Nemo's vengefulness that Aronnax can conjure: "May the contemplation of so many [underwater] marvels extinguish his desire for revenge!"¹⁸⁴ Verne would later capitalize on this open ending by making Nemo "the secret of the island," the explanation for a series of mysterious occurrences in *The Mysterious Island*, which suggests that Nemo sailed to the South Pacific after escaping the maelstrom. After saving Verne's protagonists in that story, Nemo dies; his burial in the *Nautilus*, which by then is moored inside a grotto, marks the story's climax. *The Mysterious Island* offers no new insight into the machinations of the *Nautilus*, though in it, for the first time, Verne identified Nemo's race, a matter on which Aronnax routinely muses in *Twenty Thousand Leagues*: he was born an Indian prince. I will return to the importance of this below.

Jules Verne, (Re)Designer of Wonders

Verne was born and raised in Nantes, a shipwright town, and he wrote *Twenty Thousand Leagues* at the beginning of a two-decade period during which he was a shipowner. In fact, he finished writing the book during one of the first voyages on his first boat, the *Saint-Michel*, a fishing boat he had retrofitted for recreational use.¹⁸⁵ In 1876 he purchased the *Saint-Michel II*, a yacht that was apparently something of a disappointment to him because he kept it for only a year before trading it for the *Saint-Michel III*, a

¹⁸³ Verne, *Twenty Thousand Leagues*, 380.

¹⁸⁴ Verne, *Twenty Thousand Leagues*, 381.

¹⁸⁵ Jean Jules-Verne, *Jules Verne: A Biography*, trans. Roger Greaves (New York, NY: Taplinger Publishing Company, 1976), 86, 119.

“thirty-eight-ton solid-iron steam yacht.”¹⁸⁶ Based on that description, Verne may have associated the *Saint-Michel III* with Nemo’s metal *Nautilus*; he kept it until 1886, the same year he published *Robur the Conqueror*, in which he imagined an aeronef, a flying ship. During these years of ship ownership, marked by retrofitting and trading up, Verne regularly thought about ships’ features and performance, and about ways to improve them.

Verne’s pattern of trading up suggests he was in search of “the ultimate ship,” a phrase Nemo uses to describe the *Nautilus*:

on board the submerged *Nautilus*, man’s heart need no longer fear. There is no change in the shape of the ship to worry about, for the double hull of this boat is as strong as anything; no rigging to be strained by the rolling and pitching; no sails for the wind to carry off; no boilers for the steam to tear to pieces; no danger of fire, for this vessel is made of metal, not wood; no coal to run out, for it is powered by electricity; no collision to be feared, since it is the only craft to navigate these deep waters; and no storms to endure, since it is a few metres below the surface and hence in absolute tranquility! Yes, it is the ultimate ship!¹⁸⁷

The ultimate ship was imaginary, a guiding ideal, a design objective for Verne; it was “ultimate” in the sense that it would make all other ships obsolete when it was finally realized. Applied to the *Nautilus*, it was something of a misnomer though, because Verne would imagine at least two more ships that superseded the *Nautilus*: Robur’s aeronef *Albatross* and his omnilocomotive *Terror*. In fact, this supersession of what he had previously imagined was essential to Verne’s style, because it was only by continually surpassing the reader’s expectations that Verne could continue to inspire wonder.

The term *wonder* here denotes both an experience and a class of artifacts associated with Renaissance art, both elements of Verne’s literary style. Arthur B. Evans has called Verne’s vehicles “dream machines,” a term that identifies them with wonders in both senses. In writing about them as wonders in the artifactual sense Evans emphasizes aesthetics, calling the Vernian machine “a thing of

¹⁸⁶ Herbert R. Lottman, *Jules Verne: An Exploratory Biography* (New York, NY: St. Martin’s Press, 1996), 210.

¹⁸⁷ Verne, *Twenty Thousand Leagues*, 87.

beauty in its own right,” “a technical device but... also a one-of-a-kind artistic creation, an *objet d’art*.”¹⁸⁸ Evans attributes the power to inspire awe to Verne’s *objets d’art* when he notes that “The real originality of [Verne’s] ‘dream machines’ lies... in their role as powerful stepping-stones to a sense of wonder.”¹⁸⁹ Here I am using the term “wonder” because it is an English correlate for the French “*objet d’art*.” I concur with Evans: Verne deployed the *objets d’art* aesthetic in describing his ships, and it did enhance the wonder of his stories. But he was also interested in the *objets d’art* aesthetic because he believed it would improve the functions of ships.

For this reason, my purpose here is to advance Evans’s insight beyond aesthetics, to show that although, as an author, Verne was thinking about his machines’ effectiveness as literary devices, as a shipowner he was thinking about their feasibility as real machines. That is, Verne was thinking about mechanical design and purpose, not just literary aesthetic and style. I appreciate Evans’s description of Verne’s vehicles as “dream machines,” but here I intend to emphasize the materiality of his design influences. It may therefore help to distinguish between wonders as a literary trope that develops over time within the romance, and wonders as a longstanding artistic tradition; we might call these, respectively, *the wonder trope* and *the wonder tradition*. This distinction makes it easier to think of wonders as both literary and material objects, which is to say that they appeared in two mutually constitutive discourses, so that literature inspired art and vice versa.

The wonder tradition represents an artifactual record of thinking about how the rare things humans *find* in the world might be incorporated into objects that are human-*made*. This found-made distinction recognizes two types of wonders that have been distinguished by Daston and Park: wonders of nature, or natural wonders, and wonders of art, or artificial wonders. Whereas wonders of nature were exclusively found and returned to a collection, wonders of art were often crafted for collectors, who

¹⁸⁸ Arthur B. Evans, “Verne’s Dream Machines,” *Extrapolation* 54:2 (2013): 129-146. See pg. 138. Notably, OED defines “*object l’art*” as “A decorative or artistic object, typically when regarded as a collectable item,” which directly associates it with the artificial wonder.

¹⁸⁹ Evans, “Verne’s Dream Machines,” 130.

tended to be political or ecclesiastical authorities. Wonders of nature included biological materials, such as shells, bones, horn, feathers, pelts, even entire body parts, such as birds' feet.¹⁹⁰ In addition to their rarity, these artifacts were wondrous because frequently associated with mythical creatures. For example, narwhal tusk was highly prized, sought for its purportedly occult properties such as its ability to neutralize poison, and was often described in romances as "unicorn horn."¹⁹¹ Wonders of nature constitute some of "nature's noblest creations, and they enveloped those around them with an aura of nobility and might."¹⁹²

Wonders of art often incorporated wonders of nature into intricate, human-made works that also included precious metals and stones, sometimes rare woods, and even "magnetic lodestones or luminescent carbuncles."¹⁹³ They were crafted not only as aesthetic objects, such as an ostrich egg mounted in gold, an obvious predecessor to the famed Fabergé Egg,¹⁹⁴ but also as purveyors of natural and supernatural forces. Among wonders of art, Daston and Park also count "what we might call wonders of engineering" designed to produce "astounding effects." "These were beautiful, intricate, precious, expensive—more akin to the work of the jeweler than that of the blacksmith."¹⁹⁵ Verne designed literarily: his stories advanced the wonder trope beyond anything yet produced within the wonder tradition. The designs of Verne's vehicles balanced delicate precision and large-scale mechanicity, avoiding real problems posed by imprecise tools and sub-par materials and evoking his readers' awe at the prowess of a budding European modernity that had not yet technologically achieved what he was imagining.

¹⁹⁰ Daston and Park list "coconuts, coral, nautilus shells, and sharks' teeth." See Lorraine Daston and Katharine Park, *Wonders and the Order of Nature, 1150-1750* (New York, NY: Zone Books, 1998), 69.

¹⁹¹ Daston and Park note the connection between 'unicorn horn' and narwhal tusk on page 69; they offer a fuller exposition of the 'unicorn horn's' "occult properties" on pages 74-75.

¹⁹² Daston and Park, 68.

¹⁹³ Daston and Park, 90.

¹⁹⁴ For which, see Daston and Park, 83.

¹⁹⁵ Daston and Park, 90.

In addition to such hidden mechanical powers, the wonder trope constructed wonders as instruments of knowledge that could shape people's values, beliefs, and behaviors, an attribution that made the conceptual model of wonder apt for describing vehicles, which by this time served scientific and imperial purposes, as Butler expounded in *Erewhon*. Daston and Park refer to the "civilizing intent" of romances, written "to foster and implant aristocratic and courtly ideals and behavior. Marvels, the aristocracy of phenomena, played a fundamental part in this project by refining sensibilities, promising mastery (including self-mastery), and providing a window onto a more opulent world."¹⁹⁶ Among the wonders thought to shape values, beliefs, and behaviors, were automata, "beings useful for the discipline and surveillance of others, and over whom their owners could have in turn perfect control."¹⁹⁷ As Daston and Park see it, "wonders of art, then, like wonders of nature, embodied a form of symbolic power, over nature, over others, and over oneself."¹⁹⁸ The mechanical vehicle was Verne's contribution to the wonder trope, and his wonder rhetoric befitted functional machines because wonders of art frequently served functional purposes. For example, some were used as containers or reliquaries, and the wonder trope historically included devices used as weapons for defense or conquest.

¹⁹⁶ Daston and Park, 91. At issue here is the scientific romance's role in cultivating nationalism among young male readers, on which ample and excellent work has been done. Martin Green has treated Verne's stories as children's literature, arguing that "The middle of the nineteenth century saw a very striking and very significant change in [British] culture's idea of children. Their literature was in effect captured by the aristomilitary caste. Adventure took the place of fable; and the adventure took on the characteristics of romance. Children's literature became boys' literature; it focused its attention on the Empire and the Frontier; and the virtues it taught were dash, pluck, and lion-heartedness, not obedience, duty, and piety." See Martin Green, *Dreams of Adventure, Deeds of Empire* (New York, NY: Basic Books, Inc., 1979), 220. Since then, John MacKenzie has argued that the patriotic and imperialistic values of "boys' literature" emerged in the 1850's but did not mature until the last two decades of the nineteenth century, when it appeared in children's literature periodicals aimed specifically at young males. "The new wave of journals presented imperial ideas, in all their nationalist, racial, and militarist forms, in adventure stories and historical romances. These journals represented the distinctive late Victorian alliance of Church, State, and military"—strangely, he omits Science from this list—"and succeeded in finding the ingredients which would at the same time turn them into vehicles of the dominant *Zeitgeist* and secure a truly mass, cross-class following through excitements acceptable to the Establishment, parents, and children alike." Wonder, the phenomena of beholding wonders, was the very spirit of "acceptable excitement" as MacKenzie labels it here. See John M. MacKenzie, *Propaganda and Empire: The Manipulation of British Public Opinion, 1880-1960* (Manchester, England: Manchester University Press, 1984), 203.

¹⁹⁷ Daston and Park, 91.

¹⁹⁸ Daston and Park, 91.

One functional wonder that unequivocally influenced Verne was the *nef*, an ornate container crafted in the shape of a ship.¹⁹⁹ At diplomatic banquets, it was customary to set a nef before an exalted guest, frequently a foreign emissary, doubtless to inspire wonder at the court's wealth and the prowess of its artisans. In religious ceremonies nefs held holy relics, ceremonial objects, or the elements of the Eucharist. The Victoria & Albert Museum houses one of the most famous extant nefs, the Burghley Nef, which traveled to England in a diplomatic exchange. Made in Paris in 1527, the Burghley Nef is a miniature of a military ship with “a battlemented poop [deck]” and “fighting tops”; the ship's prow sports “a figurehead in the shape of a wolf's head” and its hull is made of nautilus shell.²⁰⁰ In the nef, animal material, animal form, and military purpose were all incorporated into a vehicular shape that eventually became mechanized. During the 1600s, artisans began incorporating clockwork into nefs so that they “could run down the dinner table and lower the tension at tedious banquets.”²⁰¹

By describing the *Nautilus* as a nef, Verne defined what it was that had led him to associate the ship and the horse in *Hatteras*: biomorphism. In general, the wonder aesthetic preserved a sense of machines' animality even while human metalwork and machinery replaced animal bodies as vehicles in mid-nineteenth-century Europe. Beyond its mere appearance, the *Nautilus* functions as a nef, a reliquary,

¹⁹⁹ The Historical Context Note in the Burghley Nef's description information indicates that “The January miniature from the Très Riches Heures manuscript (c 1413–16) of Jean, Duc de Berry, shows a large nef placed to the left of the principal diner, as does the painting for the same month in the Flemish-made Grimani Breviary, of about 1510-20. Nefs were particularly prized in France and Italy, where noble and royal inventories dating back to the 13th century list copious silver and gold ships, but their appeal was more widespread, reaching Germany, Spain and the Low Countries.” See “The Burghley Nef,” V&A Search the Collections, updated 11 September 2018, accessed 11 September 2018, <http://collections.vam.ac.uk/item/O73113/the-burghley-nef-salt-cellar-unknown/>. John of Berry's collection is notably described by Daston and Park thus: “an ostrich egg, a snail shell, seven boars' tusks, a porcupine quill, a giant's molar, a large serpent's jaw, a coconut shell, a number of pieces of red coral, a white bearskin, and at least three whole unicorn horns.” See Daston and Park, pgs. 86-88.

²⁰⁰ “The Burghley Nef,” V&A Search the Collections, 11 September 2018, accessed 11 September 2018, <http://collections.vam.ac.uk/item/O73113/the-burghley-nef-salt-cellar-unknown/>.

²⁰¹ Charles Oman, *Medieval Silver Nefs* (London, England: Her Majesty's Stationery Office, 1963). Oman's pamphlet, written when the Victoria and Albert Museum acquired the Burghley Nef, linked nefs to the French romance and cites mentions of the artifact in romances dating to the thirteenth century. I have refrained from citing page numbers here because Oman's work is a brief pamphlet punctuated by glossy photographs of various nefs. Perhaps here is also a good place to note that in using the word “open” to describe the heterotopia, and then identifying the boat or the ship as the heterotopia *par excellence*, Foucault may very well have been punning on the nef after the manner of Verne because the nef, as a storage vessel, opens up.

a shell around Nemo and his scientific wonders, including his life-sustaining machinery, his museum and library, and, in a characteristically Vernian pun, his organ. In its spar we recognize the narwhal tusk, which ostensibly purges the poison of empire from the sea by piercing the hulls of modern nations' ships. When the submarine runs aground in the Torres Strait and Aronnax and his friends are allowed a few days ashore, it sits before them as they eat a paradisaal feast on the beach, a symbol of their negotiation with Nemo and of his power to bear them away when a hostile tribe attacks the ship. The *Nautilus* is also a tool of knowledge-power: its window affords a unique view of the undersea realm that sustains the distance between Aronnax and the species he observes, reifying the nature-culture divide as he and his friends taxonomize while dining in civilized comfort.

Animal Locomotion and the Mechanical Body

Mid-nineteenth-century scientific writers had already permuted the conceptual models of animality, mechanicity, and wonder. Mid-nineteenth-century zoologists regularly used mechanistic language to describe animal anatomy and physiology. Recalling the Cartesian beast-machine, Linnaeus described animals' appendages and other corporeal structures as weapons and tools when he referred to the "various arms which [animals] carry for their defence, and the instruments with which they go about their various employments."²⁰² For Linnaeus, these structures inspired wonder because he saw in them the handicraft of God. Therefore, a century before Verne began writing, animality, mechanicity, and wonder had already been permuted in scientific discourses describing the designs of animal bodies. Over time, the kind of wonder Linnaeus's writing exudes began to fade as anatomy and physiology became increasingly involved in a Coleridgean "analysis terminable" that entailed dissecting animal bodies in order to understand what they were made of and how they worked. One of the objects of such analysis was understanding how animal bodies moved and how their appendages aided in aerial or underwater

²⁰² Carl von Linné, *Reflections on the Study of Nature* (London, England: George Nicol, 1785), 19. For a history of Descartes's beast-machine in literature see Wallace Shugg, "The Cartesian Beast-Machine in English Literature (1663-1750)," *Journal of the History of Ideas* 29:2 (April - June 1968): 279-292.

locomotion, the focal project of the animal locomotion research that emerged early in the nineteenth century.

Verne's contribution was to resuscitate wonder by inverting the Cartesian beast-machine to demonstrate that animalizing a machine was a viable design practice. As Norman points out, a conceptual model "doesn't have to be complete or even accurate as long as it is useful," and it is valuable only inasmuch as the assumptions that support it accurately inform the user's interaction with the design.²⁰³ In order to evoke awe, the *Nautilus* only had to be animal enough to mislead Verne's reader into thinking that *Twenty Thousand Leagues* was a sea monster story so that Verne could reveal the 'sea monster' as a machine.

This was possible because anatomy, informed by Descartes and Linnaeus, had already elided animality and mechanicity within a rhetoric of design. In *Twenty Thousand Leagues*, Verne's comments on the designs of fishes' bodies suggest animal locomotion research's influence on his thinking. In an encomium to the scombroid tuna, Aronnax gushes, "I never grew tired of admiring animals so well designed for racing, with their little heads, their streamlined, slender bodies, in certain cases longer than three metres, their pectorals of remarkable strength, and their forked caudal fins."²⁰⁴ Elsewhere, Verne describes a pair of blue sharks using human-made materials. They have "dull, glassy eyes," "Monstrous fiery mouths," and "iron jaws."²⁰⁵ In another passage, Land opines that "'sharks are quite poorly designed animals. They have to turn on their stomach to bite you, and during that time...'"²⁰⁶ These are typically-Cartesian, machine-like animals.

Verne's originality as a designer shows in his inversion of Descartes's machine-like animal, in his animalization of machines. As the *Nautilus* passes a sinking ship, Aronnax mourns it as "A sad sight, this

²⁰³ Norman, 25-26.

²⁰⁴ Verne, *Twenty Thousand Leagues*, 237.

²⁰⁵ Verne, *Twenty Thousand Leagues*, 117.

²⁰⁶ Verne, *Twenty Thousand Leagues*, 195. For all Land's sailorliness, this is clearly a landlubber's perspective, for it takes no account of the fact that the shark is an aquatic predator, more likely to prey upon fish below it in the water than on humans in boats above it.

carcass lost beneath the waves.”²⁰⁷ Later, he describes sunken wrecks in the Mediterranean as standing “upright like fierce animals.”²⁰⁸ Here, Verne synthesized the conceptual models of animality and mechanicity into a language of bodily design, eliding the material differences between animals and machines and demonstrating that if animals could be described as mechanical, then machines could be described as animal. This Vernian inversion resuscitated the awe of the animal-machine relationship by suggesting that the intricate designs Linnaeus once attributed to God were now within the purview of humankind.

Whereas Verne’s association of the ship with the horse in *Hatteras* is mere poesy, his animalization of the *Nautilus* was the logical extension of the design thinking that led to the development of the *hélice*, which was the subject of an intense debate to which Verne was privy during the 1860s.

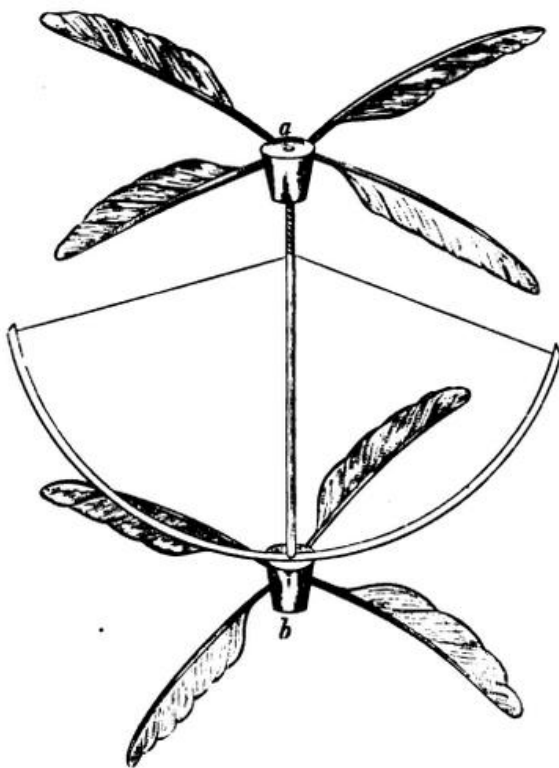


Figure 3: Cayley's propeller prototype

Hélice is a French word, often translated in English as “screw” or “propeller”; Verne saw the *hélice* as a mechanical appendage, a machine body part that could facilitate his mechanimal bodies’ locomotion. In “On Aerial Navigation,” anatomist George Cayley described a working model of a propeller, a toy constructed from whale bone and bird feathers. Cayley believed human flight was physically possible and saw the problem of a workable flying machine as fundamentally technological, asserting that “nothing more is necessary, in order to bring the following

²⁰⁷ Verne, *Twenty Thousand Leagues*, 124.

²⁰⁸ Verne, *Twenty Thousand Leagues*, 243.

principles into common practical use, than the endeavors of skillful artificers, who may vary the means of execution, till those most convenient are attained.”²⁰⁹ The propeller was Cayley’s answer to an anatomical problem human flight faced: inadequate pectoral musculature to propel or even stretch out a pair of wings. Provided that a light and efficient engine could be developed so that a human would not have to bodily supply power to the propeller, a mechanical means of aerial locomotion was possible. “For the mere purpose of ascent,” Cayley argued, the propeller was “perhaps the best apparatus.”²¹⁰

Verne likely became aware of the hélice through the work of Gabrielle de la Landelle, Gustave Ponton d’Amécourt, and Gaspard-Félix Tournachon, alias Nadar. A friend of Verne’s, Nadar was a polymathic technological pioneer. At one point he owned *Le Geant*, an infamous balloon that crashed more than once with passengers aboard. Nadar thus recognized the promise of the propeller and

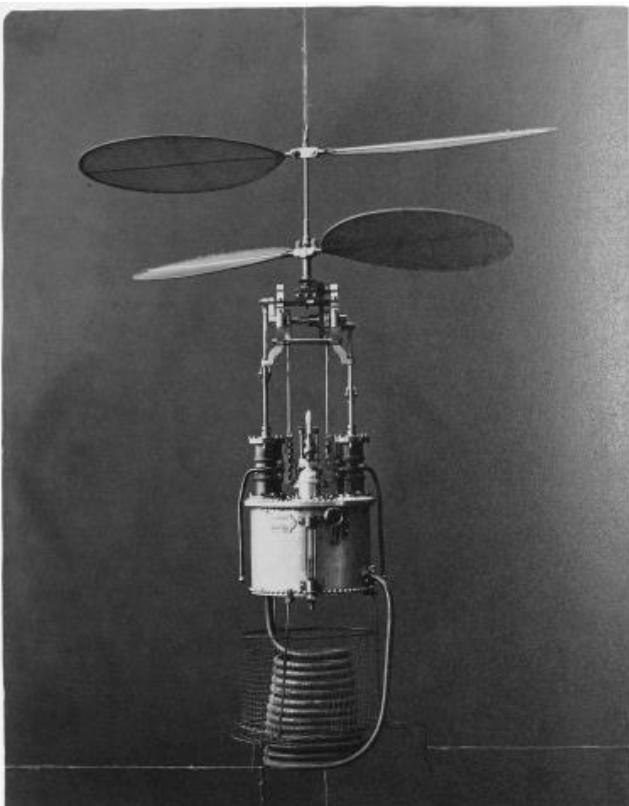


Figure 4: A photo Nadar made of one of his, Landelle’s, and d’Amecourt’s propeller prototypes

partnered with Landelle and d’Amécourt in developing workable mechanical prototypes of Cayley’s model. As a pioneering photographer, he popularized the work by photographing portraits of the prototypes. Understandably then, Nadar was the charismatic public face of the Société d’encouragement pour la locomotion aérienne au moyen d’appareils plus lourds que l’air (the Society for the Encouragement of Aerial Locomotion by Means of Heavier-Than-Air Machines), which formed in 1863; Verne was one of its earliest members. Journalists humorously nicknamed

²⁰⁹ George Cayley, “On Aerial Navigation,” *A Journal of Natural Philosophy, Chemistry, and the Arts* 24 (1809): 164-174. See pg. 164.

²¹⁰ Cayley, “On Aerial Navigation,” 173.

it Les Chevaliers de la Sainte Hélice—The Knights of the Holy Propeller.²¹¹ The Société’s members saw themselves as underdogs extolling the power of the *hélice* in a world overawed by aerostats, lighter-than-air craft such as balloons. Landelle et al. argued that the aerostat was an unnatural way to fly, an argument that Verne later popularized in *Robur the Conqueror*: “Progress is not in aerostats at all... it is in flying machines. The bird flies, and it is not in any way a balloon; it is a machine!... Ever since the flight of great and small flyers was first studied, one simple idea has prevailed: that all that has to be done is to imitate nature, for nature is never wrong.”²¹² The word “*hélice*,” often lost when translating Verne’s stories to English, is an important link to the word “helix,” which describes the shape of the *hélice*’s motion but also suggests a theory of animal locomotion published by the Scottish physiologist James Bell Pettigrew around the time Verne was writing *Twenty Thousand Leagues*. Pettigrew argued that all animal locomotion inscribes a helictical (figure-eight) pattern, and his findings were corroborated by the French anatomist Étienne-Jules Marey, whose work Verne cited in *Robur the Conqueror*.²¹³

²¹¹ Alex Kirstukas, “Introduction,” *Robur the Conqueror*, ed. Arthur B. Evans, trans. Alex Kirstukas (Middletown, CT: Wesleyan University Press, 2017), vii-ix.

²¹² Verne, *Robur the Conqueror*, 27. Robur’s ultimate ship was an *aeronef*, a flying ship lifted by propellers, an early version of what is now known as a helicopter.

²¹³ Pettigrew, a Scottish surgeon and anatomist, published his work on animal flight in 1867, arguing that “The movements of the margins [of a bird’s wing] during flexion and extension may be represented with a considerable degree of accuracy by a figure of 8 laid horizontally.” See James Bell Pettigrew, *On the Mechanical Appliances by which Flight is Attained in the Animal Kingdom* (London, England: Taylor & Francis, 1868), 233. According to Pettigrew, the figure-eight represented the locomotion of all animals and could be recognized regardless of structure. While he had not yet clarified that his motion was universal, he was first to discover it. He would go on to clarify its universality in *Animal Locomotion; or, Walking, Swimming, and Flying, with a Dissertation on Aëronautics* (London, England: H. S. King & Co., 1873). That same year, in Paris, Marey would publish *La Machine Animale: Locomotion Terrestre et Aérienne*, in which he observed that if the tip of a wing modeled after an insect’s was exposed to the cylinder apparatus he was using to record its motion, “Nous obtiendrons, si le cylindre est immobile, des figures en 8 lorsque l’aile touche la papier par sa pointe perpendiculairement appliquée sur sa surface, et, si le cylindre tourne, on aura de 8 déployés.” (“We will obtain, if the cylinder is still, figures-of-8 where the wing touches the paper with its perpendicular point, and, if the cylinder turns, we will have 8 deployed [i.e., recorded horizontally].”) See E. J. Marey, *La Machine Animale: Locomotion Terrestre et Aérienne* (Paris, France: G. Baillière, 1873), 200. (Readers who prefer to read in English might rather consult E. J. Marey, *Animal Mechanism: A Treatise on Terrestrial and Aerial Locomotion* (New York, NY: D. Appleton & Co., 1874), 191.) Pettigrew would later quarrel with Marey, charging that the latter had presented this idea as his own well after Pettigrew had published it. For Pettigrew’s description of this quarrel, see Pettigrew, *Animal Locomotion*, 15-16.

Whether and how Verne knew about Pettigrew’s research on animal locomotion is unclear, but it’s difficult to believe that he had never read Pettigrew’s work. Both were heavily invested in the idea of the “screw” (English) or *hélice* (French) as a means of propulsion, Pettigrew having argued that all animal locomotion formed a helix and

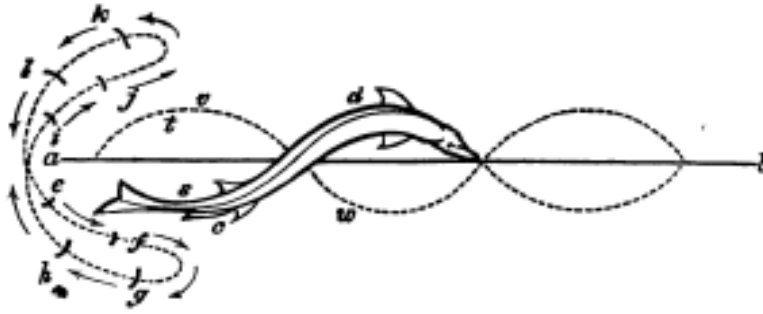


Figure 5: Pettigrew's drawing of a fish's helicoidal locomotion

The *hélice*'s most wondrous power was its ability to propel vehicles through more than one element: whereas the Knights of the Holy Propeller advocated it as a means of aerial locomotion, Verne recognized its potential for aquatic locomotion as well. In the passages where Nemo explains the *Nautilus*'s steering and control apparatuses, Verne uses the word “*hélice*” in the original French. Pettigrew noted that “a close analogy exists between the flippers, fins, and tails of sea mammals and fishes on the one hand, and the wings of insects, bats, and birds on the other; in fact, that theoretically and practically these organs, one and all, form flexible *hélices* or screws.”²¹⁴ From there he argued that a

that “the flipper of the sea bear, the swimming wing of the penguin, and the wing of the insect, bat, and bird, are screws *structurally*, and resemble the blade of an ordinary screw.” See Pettigrew, *Animal Locomotion*, 15. *Animal Locomotion* was not translated into French until 1874; since Verne told Belloc that he only read in French, this date suggests that Pettigrew's research was not an influence on Verne's imagination of the *Nautilus*. Moreover, if Pettigrew's timeline in *Animal Locomotion* is accurate, then neither could Marey's lectures, which reiterated Pettigrew's research, have influenced Verne in writing *Twenty Thousand Leagues*, for Marey's lectures were presented in 1872, well after the book was published. This is not to say that one of Pettigrew's earlier works had not been translated and been an influence, though I can find no record of any such translation and Pettigrew does not acknowledge any such translation in the account of having communicated his work to the French Academy of Sciences, which he claims he did in 1870.

Nevertheless, Verne's *Robur the Conqueror*, which came well after *Animal Locomotion* was translated, could easily have been influenced by Pettigrew. *Robur's Albatross* was modeled on Landelle's *aeronef*, which was itself based on Cayley's flying apparatus. Cayley's apparatus had also been the inspiration for Nadar's gadgets, all of which Pettigrew wrote about in *Animal Locomotion*, for which see pg. 217. When *Robur* makes his argument for the possibility of heavier-than-air flight at the Weldon Institute he cites flying species as examples, noting that the bee flaps its wings “192 times a second” and the fly, “330”; Marey's experiments, recounted in *Animal Mechanism*, established these at 190 and 330 beats per second, respectively. See Etienne-Jules Marey, *Animal Mechanism: A Treatise on Terrestrial and Aërial Locomotion* (New York, NY: D. Appleton & Company, 1874), 185. Marey's name is also mentioned elsewhere in the book; see Verne, *Robur the Conqueror*, 55. Pettigrew's own timeline in *Animal Locomotion*, cited above, establishes that by then he had influenced Marey, by Marey's own admission.

²¹⁴ Pettigrew, *Animal Locomotion*, 14.

screw design he proposed for traveling through the air could also be “adapted in a marked manner for water,”²¹⁵ a technological vision that promised Verne a series of machines, some of which could travel under water and some of which could travel through the air. Each of these promised its own story, as with the *Nautilus* and the *Albatross*. Moreover, the existence of swimming birds, such as penguins, and of various species of flying fish, suggested the eventual feasibility of an omnilocomotive like Robur’s *Terror* in *Master of the World*.²¹⁶ For Verne, then, animalizing machines was the key to developing new mechanical means of locomotion, but also to optimizing the functions of existing machines.

British Polar Exploration Vessels and the Design of the Ultimate Ship

The romance always expresses desire and usually fulfills the desire it expresses; the scientific romance adheres to this convention but substitutes scientific means for older romances’ supernatural miracles. The designs of Verne’s ships in *Les Voyages Extraordinaires* evince his desire for a ship that was better-designed than the real ships of his time. They also suggest he did not start from scratch but, since he wanted literary ships that could take his readers on imaginary global explorations, he refined the designs of real exploration vessels. This raises an important question: *which* ship or ships was Verne redesigning?

William Butcher has offered the most comprehensive study of Verne’s possible influences, including real submarines that “were ultimately designed to attack British warships.”²¹⁷ One might easily

²¹⁵ Pettigrew, *Animal Locomotion*, 257.

²¹⁶ For which see Jules Verne, *Maître du monde* (Paris, France: Hetzel, 1902). In English, see Jules Verne, *Robur the Conqueror: and Master of the World* (New York, NY: Didier, 1951). When Verne’s oeuvre is considered literarily, *Master of the World* is a minor text, though it is notably one of the last stories he finished. However, when considered as a record of imaginary, futuristic vehicles, it marks a significant advance in Verne’s thinking.

²¹⁷ William Butcher, ed., “Appendix: Sources of Ideas on Submarine Navigation,” *Twenty Thousand Leagues Under the Seas*, by Jules Verne (Oxford, England: Oxford University Press, 1998), 382. Here Butcher is overly focused on submarines, to the unnecessary exclusion of surface ships that might have influenced Verne. This overemphasis on submarines is common in thinking about the design of the *Nautilus*, not least because it is obviously relevant to the question of how to illustrate Verne’s famous machine. For examples, see Ron Miller, “Which Real-Life Victorian Sub Inspired Jules Verne’s *Nautilus*?” *Gizmodo*, 27 March 2014; available from <https://www.higheredjobs.com/faculty/details.cfm?JobCode=177125363&Title=Assistant%20Professor%20of%20Global%20Literature>; and Michael Crisafulli, “The *Nautilus*’ Interior”; available from <http://www.verniana.com/Nautilus/layout.html>.

surmise that Ships of the Fleet did not influence Verne's thinking because his design influences were inimical to British warships; this would be a mistake. In fact, much of Verne's writing was influenced by British explorers. In his introduction to *The Adventures of Captain Hatteras*, Butcher noted that the story "borrows extensively from scores of polar accounts, nearly all British,"²¹⁸ many of which had been translated into French by that time. In fact, Volker Dehs's bibliography of Verne's library indicates he owned a French translation of John Ross's *Narrative of a Second Voyage in Search of a North-West Passage*,²¹⁹ which Butcher recognizes as the exploration account that influenced Verne most while he was writing *Hatteras*.²²⁰ Butcher's introduction to *Hatteras* offers the earliest and most careful attention to British explorers' influence on Verne; but even there, the implication is that they primarily influenced *Hatteras*, for *Twenty Thousand Leagues* receives nary a mention. I therefore propose to clarify Butcher's 1998 appendix to *Twenty Thousand Leagues*, which could be misread to the effect that Verne was not influenced by the Royal Navy's ships, by drawing from his 2005 introduction to *Hatteras*, which insists that Verne was heavily influenced by British polar exploration accounts, particularly John Ross's. Nor did this influence wane: *Hatteras* was the first of *Les Voyages Extraordinaires*; after it was published, British polar exploration pervaded several of Verne's later stories and received detailed treatment in his history, *Great Explorers of the Nineteenth Century* (1881).

Among those mentioned in *Great Explorers* are John Ross, his nephew James Clark Ross, and their friend John Franklin, each of whom contributed significantly to Verne's thinking about ship design. As noted above, Verne owned a copy of the account of John Ross's second voyage, which was the first attempt to explore the Arctic with a steam-powered ship. James Clark Ross captained the most

²¹⁸ William Butcher, ed., "Introduction," *The Adventures of Captain Hatteras*, by Jules Verne (Oxford, England: Oxford University Press, 2005), xiv.

²¹⁹ The work from Verne's library, documented by Volker Dehs, was the French translation of Ross's book: John Ross, *Relation du second voyage fait à la recherche d'un passage au Nord-ouest*, trans. Defauconpret (Paris, France: Belizard, 1835). See also Volker Dehs, "La bibliothèque de Jules et Michel Verne," *Verniana: Jules Verne Studies* 3 (2010-2011); available from <http://www.verniana.org/volumes/03/HTML/Bibliotheque.html>. The original is John Ross, *Narrative of a Second Voyage in Search of a North-West Passage, and of a Residence in the Arctic Regions During the Years 1829, 1830, 1831, 1832, 1833* (London, England: A. W. Webster, 1835).

²²⁰ William Butcher, ed., "Introduction," *The Adventures of Captain Hatteras*, xv.

comprehensively planned and scientifically productive expedition of the nineteenth century, such that his accomplishments were the scientific-explorational standard against which Verne compared Nemo's endeavors in *Twenty Thousand Leagues*. John Franklin's expedition became Royal Navy legend, lost to all knowledge in a fated attempt to chart the Northwest Passage. I. O. Evans, who translated *Hatteras* during the 1960s, once noted that Verne "was especially stirred by the mystery which had long surrounded the fate of Sir John Franklin and by Lady Franklin's efforts to rescue him."²²¹ It is therefore no wonder that in an 1895 interview with Marie Belloc, Verne, reflecting on his writing career, intimated that "members of the English-speaking race make excellent heroes, especially where a story of adventure, or scientific pioneering work, is about to be described. I thoroughly admire the pluck and go-ahead qualities of the nation which have planted the Union Jack on so great a portion of the earth's surface."²²² I would argue that we see the Royal Navy's influence on Verne even in *Twenty Thousand Leagues*, for Nemo surpasses any nineteenth-century British exploration by attaining the South Pole, which no human would reach until the Amundsen Expedition in 1911. Moreover, the Rosses' accounts contain details about the importance of good ship design for reaching the uncharted regions of the globe. For this reason, I examine how the *Nautilus*'s design solves problems faced by the Rosses and Franklin because the *Nautilus* could not have been convincingly described as "the ultimate ship" without being designed to overcome the problems these explorers faced, and its mechanimality—its unique, wonder-evoking synthesis of animality and mechanicity—is essential to Verne's problem-solving design.

John Ross commanded his first polar expedition in 1818,²²³ a search for the legendary Northwest Passage that made him a controversial public figure. Upon returning, one of Ross's officers, Edward

²²¹ I. O. Evans, *Jules Verne and His Work* (London, England: Arco Publications, 1965), 43. Presumably, Evans was alluding to Verne's mention of Franklin's lost expedition in *Hatteras*, a two-part English translation of which Evans himself edited. See Jules Verne, *At the North Pole: Part One of The Adventures of Captain Hatteras*, trans. I. O. Evans (Westport, CT: Associated Booksellers, 1961), and Jules Verne, *The Wilderness of Ice: Part Two of The Adventures of Captain Hatteras*, ed. and trans. I. O. Evans (Westport, CT: Associated Booksellers, 1961).

²²² Belloc, 22.

²²³ This date would have been significant to popular readers, who would have associated Ross with Mary Shelley's icebound Captain Walton, whose narrative frames the story in *Frankenstein*.

Sabine, charged that he had passed by what Ross believed was only a bay in Lancaster Sound because he had seen distant peaks he had even named—Croker’s Mountains. Although Sabine and others disagreed with Ross’s decision to sail past this “bay,” they waited to voice their dissent until the expedition had begun its return voyage to England and it was too late for him to undertake a more thorough search. The disagreement became public when Sabine published his journal, which poisoned the Admiralty against Ross.²²⁴

Verne sympathized with Ross²²⁵ and likely agreed that the 1829 expedition was Ross’s opportunity to redeem himself by reopening the search for the Northwest Passage with a steam-powered ship. While sidelined by the Admiralty for a decade, Ross had published *A Treatise on Navigation by Steam* (1828), arguing that Britain’s naval and maritime fleets would benefit from developing steam-powered ships. Thanks in no small part to the *Treatise*, Ross procured the patronage of a private investor and purchased an old packet boat, the *Victory*, which he refitted as an icebreaker. He raised its sides to increase its capacity for carrying supplies and added a new two-boiler steam engine and side paddles. According to Dodge, in this Ross “was far ahead of naval officialdom. The prejudice against steam in the Royal Navy extended all the way from the Lords of the Admiralty to the lowest rating... Sailors are notoriously conservative, and early engines were not reliable. John Ross was one of the few men in the navy who saw the potentialities of steam-power.”²²⁶ As such, Ross epitomized the sort of “pluck and go-

²²⁴ Dodge certainly agreed. In his estimation, John Barrow, Secretary of the Admiralty until 1845, systematically thwarted John Ross’s career after Ross’s 1818 voyage. In Dodge’s words, “If John Ross had sailed through the North-west Passage in a butter firkin Barrow would not have recognized it as a feat of any consequence.” See Ernest S. Dodge, *The Polar Rosses: John and James Clark Ross and Their Explorations* (London, England: Faber, 1973), 119.

²²⁵ As Verne described it, Ross’s previous, “extraordinary exploration of Baffin’s Bay had brought upon him the censure of the Admiralty, and [he] was anxious to regain his reputation for skill and courage.” See Jules Verne, *Great Explorers of the Nineteenth Century* (London, England: S. Low, Marston, Searle & Rivington, 1881), 374.

²²⁶ Dodge, *The Polar Rosses*, 112-113.

ahead qualities” Verne admired, and his effort to retrofit an old packet boat likely reminded Verne of his own experience retrofitting the *Saint-Michel*.²²⁷

The *Victory* was widely regarded as a technological wonder and Ross invited “several persons of rank and science”²²⁸ to see the ship before it departed. As Dodge described it, “The expedition fired the public imagination. Using steam was something new and everyone wanted to see the unusual ship that would make a new try for the North-west Passage. The Lords of the Admiralty visited the ship... Nobility, politicians, scientists and fellow explorers all wanted Ross to show them his strange vessel. It became the social thing to do for the season.”²²⁹ Although Verne owned Ross’s travelogue, he may have earned of the *Victory* some other way because the ship was famous in France—the Duke d’Orleans, later King Louis Philippe I, was among those present to witness its historic departure.²³⁰

The *Victory* became locked in Arctic ice and Ross and his crew were stranded for over two years; like Aronnax and his friends, they spent much of this time in the ship’s hold. During that time, Captain John Ross’s nephew, Commander James Clark Ross, located and planted the Union Jack on the northern magnetic pole. “J. C. Ross,” as his uncle referred to him, had over a decade of experience in polar exploration by then, which he put to good use by making several excursions from the icebound *Victory* to survey the area and trade with indigenous people for fish, game, canoes, and dogsleds which were instrumental in keeping the crew alive and in getting them back to Baffin Bay, where they were coincidentally rescued by Ross’s ship from the 1818 expedition, the *Isabella*. Since they had long been

²²⁷ Another explanation would be that Verne was inspired to retrofit a fishing boat, rather than to purchase a pleasure craft, by reading Ross’s *Narrative*. But I leave the exploration of this possibility to French literature scholars who have readier access to Verne’s writings.

²²⁸ John Ross, *Narrative of a Second Voyage in Search of a North-West Passage, and of a Residence in the Arctic Regions During the Years 1829, 1830, 1831, 1832, 1833* (London, England: A. W. Webster, 1835), 7.

²²⁹ Dodge, *The Polar Rosses*, 119.

²³⁰ Lottman, 213-214. According to Lottman, during an 1878 voyage to Le Tréport aboard the *Saint-Michelle III*, Verne gave an original manuscript of *Twenty Thousand Leagues* to Philippe D’Orleans, Count of Paris and grandson of Louis Philippe I. Fantastic though it sounds, perhaps Verne came by his copy of Ross’s *Narrative of a Second Voyage* through an exchange of gifts on this occasion. A careful review of the copy in his personal collection might yield valuable paleographic evidence to prove or disprove this hypothesis.

counted for dead, their return in 1833 was cause for wonder, the stuff of romance, even though they returned without *Victory*.



Figure 6: *The Victory*, newly refitted, leaving port on Ross's 1835 expedition

By his own account, Ross's second expedition had fared worse than his first, owing largely to bad ship design. In *Narrative of a Second Voyage* he blamed the loss of the *Victory*—and his second failure to locate a Northwest Passage—on the ship's malfunctioning steam engines, dismissing them as a “patent contrivance.”²³¹ The engines' repeated breakdowns slowed the *Victory*'s pace; worse, they became unworkable before the ship ever reached Arctic waters. Ross addressed his account to King William IV and defamed the engines' “execrable machinery,”²³² prompting a rejoinder from their designer, John Braithwaite, whose railway engine boilers were somewhat famous. The ensuing, very public argument

²³¹ Ross, *Narrative*, 3.

²³² Ross, *Narrative*, 10.

between Ross and Braithwaite included important mechanical details that Verne may have read and would likely have found useful as he imagined the workings of the *Nautilus*.

The *Victory*'s other malfunctions included its large draft,²³³ leaky boilers, paddle wheels that delved too deeply into the water, a malfunctioning condenser apparatus, and an overly complicated, faulty transmission. Ross traced all of these problems back to Braithwaite's poor workmanship and argued that they had reduced the *Victory*'s power, slowing its progress and making it useless for breaking through the polar pack. Ross charged that Braithwaite had contracted to build copper boilers, which would have been relatively light, but instead delivered iron boilers, which were much heavier and increased the *Victory*'s draft, the depth of its hull below the water line. This large draft was a problem because it made the *Victory* less agile—unlike Hatteras's ship—and increased the risk it would run aground on ice, reefs, shoals, and shallows while navigating uncharted waters.²³⁴ By imagining the *Nautilus* as a submarine, Verne turned the problem of a large draft into a solution: running altogether below the surface, Nemo's *Nautilus* travels beneath polar ice instead of attempting to float above or between submerged bergs, “slid[ing] with the skill of a cetacean through the narrow bottlenecks of the hills.”²³⁵ This maneuverability allows the *Nautilus* to avoid reefs and even discover an underwater tunnel that connects the Red Sea with the Mediterranean Sea.

Ross had angled the paddles in the *Victory*'s side wheels, making a crude sort of *hélice* in order to drive water away from the ship's hull. Braithwaite argued that the *Victory* had made slow progress

²³³ A ship's “draft” is the distance between the bottom-most point of its keel and the water line, effectively, the height of the part of the ship that rides below the water's surface. Ross used the British spelling “draught,” which I have Americanized in my own prose.

²³⁴ When they tried to row from Tuktoyaktuk, Northwest Territory, to Pond Inlet, Nunavut, the crew of the *Arctic Joule* experienced some of these navigational problems. At one point they ran aground unexpectedly while holding course 100 meters from the shoreline; at another point they were iced into a bay in which they were taking refuge. It should be noted that the *Arctic Joule* was a lighter, smaller craft with a much shallower draught than the *Victory*, and it was traveling in 2015, when water levels are higher and ice is sparser due to polar melt. As such, the documentary of the *Arctic Joule*'s voyage is a valuable resource for any scholar who wants a clearer understanding of the conditions to which the Ross and Franklin expeditions were exposed. See Frank Wolf, dir., *The Hand of Franklin* (Nunavut, Canada: Saveur Films, 2015).

²³⁵ Verne, *Twenty Thousand Leagues*, 264.

because these new paddles put too much strain on the engines,²³⁶ breaking the teeth of the transmission gear that transferred power from the engine to the paddles and the condenser. When the condenser lost power, the crew had to work its pumps and bellows by hand in temperatures exceeding 95 degrees Fahrenheit. When one of the crew fainted, Ross decided that running the engine was worth neither the fresh water the crew needed to continue working it nor the strain they endured while doing so.²³⁷ Worst of all, the engine's boilers leaked incessantly.²³⁸ At best, a leaky boiler meant a loss of propulsive power; at worst, it could explode. Braithwaite had anticipated the possibility of a leak and advised Ross to have his crew throw potatoes and human dung into the boiler to reseal it.²³⁹ For Ross's men operating the bellows and pump in close, hot quarters, the smell of burnt potatoes and excrement made already arduous work unbearable.

When the *Victory* finally became stranded in the Arctic, Ross gave orders to lighten it in hopes of making it shallower on the draft to free it from the ice. The toll its poor design had taken on morale is worth quoting at length:

The last of the engine was hoisted out: may I not say that there was not one of us who did not hail this event with pleasure. We could not even look at its fragments without recollecting what it ought to have been, and what it proved to be; nor without reflections, and those not kind ones, on its maker, when we remembered the endless and ever recurring trials of our patience which it had caused, the never ceasing labour of the men in its reparation, the ever renewed hopes, producing ever new disappointments, and the loss of temper, to most of us, I fear, of which it had been the fertile cause. The enemy, however, was at last at our feet; and while it was incumbent on us to store it up, though it would in reality be difficult to say why, were it not from that habit, or feeling, which rebels against absolute wastefulness, I believe there was not one present who ever again wished to see even its minutest fragment.²⁴⁰

²³⁶ John Braithwaite, *Supplement to Captain Sir John Ross's Narrative of a Second Voyage in the Victory, in Search of a North-west Passage Containing the Suppressed Facts Necessary to a Proper Understanding of the Causes of the Failure of the Steam Machinery of the Victory and a Just Appreciation of Sir John Ross's Character as an Officer and a Man of Science* (London, England: Chapman and Hall, 1835), 4-8.

²³⁷ Ross, *Narrative*, 7.

²³⁸ Apparently, this was a problem with the Braithwaite design because during the fall of 1829, while the *Victory* was struggling through Lancaster Sound, one correspondent complained about his Braithwaite boiler's leaks and risks of explosion, though that particular boiler was installed on a railway engine. See L. Herbert, "Braithwaite and Ericsson's Steam-Engine Boiler," *Iron. An Illustrated Weekly Journal for Iron and Steel Manufacturers, Metallurgists, Mine Proprietors, Engineers, Shipbuilders, Scientists, Capitalists* 12 (1829-1830): 199-201.

²³⁹ Ross, *Narrative*, 10.

²⁴⁰ Ross, *Narrative*, 205.

Whereas Aronnax refers to the *Nautilus* as an “intelligent boat,”²⁴¹ Ross’s men “felt that they were fast ridding themselves of a nuisance; of an enemy, where they had reckoned on a friend,”²⁴² a description that hardly conceals his and his crew’s hatred for the ship’s malfunctioning and, by then, putrid guts.

Verne designed the *Nautilus*’s mechanical parts to approximate organic functions that could resolve the problems that had dogged John Ross’s *Victory*. On the night the *Nautilus* attacks the *Abraham Lincoln*, Aronnax, who at this point still believes the submarine is a biological creature, observes that “When the huge narwhal came to the surface to breathe, the air rushing into its lungs was just like the steam in the massive pistons of a 2,000 horsepower engine.”²⁴³ He later discovers that “The

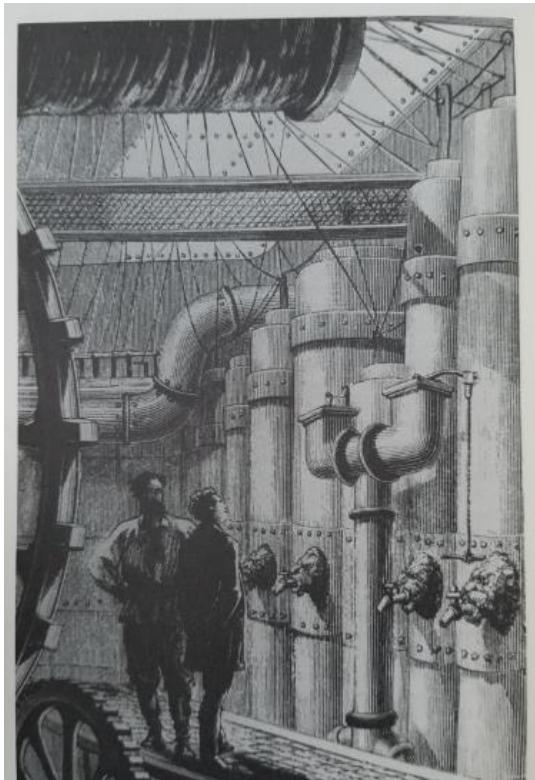


Figure 7: Riou's depiction of Nemo's *Nautilus*'s metal interior

boat, the metal monster, had obviously just come up to the surface to breathe, exactly as whales do. How the ship was ventilated was now perfectly clear.”²⁴⁴ The *Nautilus*’s “breathing” rectifies the *Victory*’s under-powered pumps, which lacked the power to resupply its boilers and stoke its furnace. By contrast, the *Nautilus*’s pumps are powerful enough to oxygenate the entire ship and also help it dive and surface.²⁴⁵ Ross’s boiler woes are of no concern aboard the *Nautilus* because Verne reimaged the ship’s power source, removing steam power altogether. Nor has it any “rigging to be strained by the rolling and pitching; no sails for the wind to carry off; no boilers for

²⁴¹ Verne, *Twenty Thousand Leagues*, 212.

²⁴² Ross, *Narrative*, 204.

²⁴³ Verne, *Twenty Thousand Leagues*, 36.

²⁴⁴ Verne, *Twenty Thousand Leagues*, 56.

²⁴⁵ Verne, *Twenty Thousand Leagues*, 78.

the steam to tear to pieces; no danger of fire, for this vessel is made of metal, not wood.”²⁴⁶ Instead, the entire submarine is powered by electricity. “I owe everything to the sea,” Nemo explains to Aronnax. It “produces electricity and electricity gives the *Nautilus* heat, light, and movement—in a word, life.” Elsewhere Nemo calls electricity “the soul of my machines,”²⁴⁷ and his use of the plural connotes anatomic organization. The “machines” are the ship’s internal organs, its engine and pumps, and as their “soul,” electricity harmonizes and powers their functions.

It was not enough to redesign the *Victory* in a way that resolved its problems: Verne designed the *Nautilus* to surpass even the most august accomplishments of the exploration vessels of his day. His allusion, in his interview with Belloc, to planting the Union Jack on the farthest reaches of globe bespeaks his desire for a ship that could go anywhere and facilitate its inhabitants’ study of their environs as they sailed. Ice was the greatest natural obstacle to nautical exploration, the primary barrier to the globe’s nether reaches, the North and South Poles, on which no human had yet set foot. In imagining the *Nautilus* as a ship that could go anywhere, Verne’s standard of comparison was not John Ross’s *Victory*, but J. C. Ross’s *HMS Erebus* and *HMS Terror*.

Verne saw J. C. Ross’s Antarctic expedition as the paragon of scientific exploration, not least because the younger Ross was a legend by the time he assumed command of the *Erebus* and *Terror*, two retired bomb vessels with which he circumnavigated Antarctica on a scientific survey launched in 1839.²⁴⁸ Whereas his Uncle John had become *persona non grata* with the Admiralty, J. C. Ross had returned from the dead with a rich record of scientific data on the northern magnetic pole and on the environs and wildlife of the Arctic. He and Sabine joined the Ordnance Survey in Ireland in the months following his return, and before departing for

²⁴⁶ Verne, *Twenty Thousand Leagues*, 87.

²⁴⁷ Verne, *Twenty Thousand Leagues*, 77-78.

²⁴⁸ Reflecting on this much of J. C. Ross’s career, Verne described him as “one of the most experienced of British naval officers in Polar expeditions.” See Verne, *Great Explorers of the Nineteenth Century*, 352.

Antarctica he distinguished himself yet again by saving several British whalers from foul weather in Davis Strait. Regarding this last adventure, one sailor described J. C. Ross as “without exception, the finest officer I have met with, the most persevering and indefatigable man you can imagine. He is perfectly idolized by everyone.”²⁴⁹

But Verne also recognized that J. C. Ross had planned and captained the most extensive polar exploration of the nineteenth century. The hulls of *Erebus* and *Terror* were structurally reinforced with iron to help with icebreaking and to prevent damage in icy water; their compasses were tested thoroughly before making weigh; they were well provisioned with jars and cages for specimen collection; and Ross received very specific instructions on oceanographic, geographic, and astronomical measurements they were to make along the way. For example, the expedition’s Committee of Physics charged them with making “magnetometric observations, in correspondence with those to be made at the fixed observatories” they were charged to install, with seeking out “the actual position of the southern magnetic pole,” taking “observations of the tides,” “the keeping of a regular meteorological register in both ships during the whole voyage,” taking “the temperature of the sea at the surface and at stated moderate depths,” taking “soundings... in deep seas,” collecting “specimens of the water brought up,” and making “observations... of the aurora in high south latitudes.”²⁵⁰ According to Ross’s account, similar orders were issued by the scientists on the expedition’s Geological, Zoological, and Botanical Committees.

²⁴⁹ Quoted in Dodge, *The Polar Rosses*, 182.

²⁵⁰ James Clark Ross, *A Voyage of Discovery and Research in the Southern and Antarctic Regions, During the years 1839-43, Vol. I* (London, England: John Murray, 1847), xlv-xlvi.

In *Great Explorers of the Nineteenth Century* Verne celebrated Ross's Antarctic expedition by exulting, aptly, that "The scientific harvest was abundant."²⁵¹ The *Terror's* surgeon, John Richardson, published two books, *The Ichthyology of the Voyage of the H.M.S. Erebus & Terror*²⁵² and *The Zoology of the Voyage of the H.M.S. Erebus & Terror*.²⁵³ Joseph Hooker, assistant surgeon on the *Erebus*, published a sketchbook of plants titled *The Botany of the Antarctic Voyage of H.M. Discovery Ships Erebus and Terror*.²⁵⁴ Captain Ross himself published a two-volume account, which Verne cited in *Great Explorers*.²⁵⁵

But despite such an abundant "scientific harvest," the scientists themselves still faced challenges in their research that might have been prevented by better ship design. Richardson began his *Ichthyology* with this account:

In no expedition that ever sailed from Europe has more care been taken to collect the zoological productions of the sea, than in the pre-eminently scientific one of the *Erebus* and *Terror*. The commanding officer [i.e., James Clark Ross], an accomplished zoologist, had previously paid much attention to Ichthyology, and, under his fostering superintendence, ample collections of fish were made at New Zealand, Van Diemen's Land, Australia, Kerguelen's Land, Cape Horn, the Falklands, and wherever an opportunity offered of drawing the seine or trawl, or dropping a hook. The specimens thus obtained filled many casks, and numerous jars and bottles, and it were greatly to be

²⁵¹ Verne, *Great Explorers of the Nineteenth Century*, 353.

²⁵² John Richardson, *Ichthyology of the Voyage of the H.M.S. Erebus & Terror, Under the Command of Captain Sir James Clark Ross, R.N., F.R.S.* (London, England: Edward Newman, 1844-1848). My own research on the *HMS Erebus* and *HMS Terror* began in November 2015, when I first encountered this text in the Rare Books & Special Collections of Fisher Library at the University of Sydney, Australia. For help in locating this and other works during that visit I am deeply grateful to research librarians Julie Price and Fiona Berry.

²⁵³ John Richardson and John Edward Gray, eds. *The Zoology of the Voyage of H.M.S. Erebus & Terror, Under the Command of Captain Sir James Clark Ross, R.N., F.R.S., During the Years 1839 to 1843* (London, England: Longman, Brown, Green, and Longmans, 1845).

²⁵⁴ Joseph Dalton Hooker, *The Botany of the Antarctic Voyage of H.M. Discovery Ships Erebus and Terror in the Years 1839-1843, Under the Command of Captain Sir James Clark Ross, Kt., R.N., F.R.S. & L.S., etc.* (London, England: Lovell Reeve, 1860).

²⁵⁵ James Clark Ross, *A Voyage of Discovery and Research in the Southern and Antarctic Regions, During the years 1839-43, Vol. I* (London, England: John Murray, 1847); and James Clark Ross, *A Voyage of Discovery and Research in the Southern and Antarctic Regions, During the Years 1839-43, Vol. II* (London, England: John Murray, 1848). Ostensibly, this is the "narrative" to which Verne alluded in *The Great Explorers of the Nineteenth Century*, 352.

wished that so much industry had met with the full measure of success that it deserved; but we have to regret that, during a voyage protracted for upwards of four years and a half, including every possible change of climate, and during which the ships were buffeted by many severe gales, and sustained innumerable shocks in forcing their way through the ice-packs of the Antarctic Seas, the specimens suffered very severe damage. Owing to the deterioration of the spirits in jars that were crowded with fish, and the long continued action of the brine, where that liquid was employed, very many specimens entirely perished, or merely fragments of skeletons could be rescued from the mass.²⁵⁶

The *Terror*'s design assumed that the scientist must stay above the surface of the water and that fish must consequently be brought aboard the ship for study: as a scientific instrument, the ship committed Richardson to an inhumane, marginally effective research method. Aboard Nemo's *Nautilus*, Aronnax and Conseil do not struggle to collect and classify fish²⁵⁷ because they can observe the submarine wildlife in their natural habitat through the picture window in the *Nautilus*'s salon. In addition to ichthyology, archaeology benefits from Verne's redesign, for while sailing with Nemo Aronnax encounters such wonders as sunken Spanish gold ships and the lost city of Atlantis.

Amid the exhaustive preparation for the ideal scientific exploration, J. C. Ross's preparations fell prey to the Royal Navy's conservatism; likely owing to bad experiences in the Arctic, the younger Ross set sail without fitting the *Erebus* and *Terror* with steam engines. To Verne, writing thirty years later, British suspicion of mechanically-powered ships was no longer warranted. Naturally, then, Nemo's submarine, with its electric engine, its bio-inspired *hélice*, and its narwhal-tusk spar, outmaneuvers J. C. Ross's armor-plated, supplies-laden sailing vessels. As John Ross had argued in his *Treatise on Navigation by Steam* in 1828, although the armored prow on a ship could protect it, with naught but wind power its ability to break through

²⁵⁶ John Richardson, *Ichthyology*, 1.

²⁵⁷ For the sake of my readers I will refrain from quoting Verne's lengthy passages of Linnaean taxonomy here. But for example, see Verne, *Twenty Thousand Leagues*, 95-98.

ice would be minimal. By contrast, the *Nautilus*'s spar pierces polar pack ice, allowing the submarine to travel deep into the southern latitudes.²⁵⁸

Upon reaching the South Pole, Nemo breaks into a soliloquy that exudes Verne's admiration for J. C. Ross's Antarctic expedition and aggrandizes it as the standard of comparison for the *Nautilus*'s performance:

“Finally, on 12 January 1842 the Briton James Ross, commanding the ships the *Erebus* and the *Terror*, reached 76°56'S, 171°7'E, and discovered Victoria Land; on the 23rd of the same month, he noted the 74th parallel, the furthest point reached until then; on the 27th he was at 76°8', on the 28th, 77°32', on 2 February, 78°4', and in 1842, he came back to the 71st degree, which he was not able to surpass. Well, on this 21st day of March 1868, I, Captain Nemo, have reached the South Pole and the 90th degree, and I take possession of this part of the globe, now comprising one-sixth of all the discovered continents.”

“In whose name, captain?”

“In my own, monsieur!”

And saying this, Captain Nemo unfurled a black flag, carrying a golden *N* quartered on its bunting. Then, turning to the sun, whose last rays were licking the sea at the horizon:

“Farewell, sun!” he exclaimed. “Disappear, O bright orb. Take your sleep underneath this open sea, and let a night of six months cover my new realm in its shadows!”²⁵⁹

Planting his banner thus, Nemo echoes J. C. Ross's discovery of the northern magnetic pole during John Ross's 1829 expedition. But he has sailed farther south than Ross did, and he has sailed as far south as possible; from this spot, everything is north. Nemo's achievement is scientifically significant, but also geographically ultimate.

²⁵⁸ In addition to the “pluck and go-ahead qualities” that drive Nemo to plant his banner at the South Pole, like John Ross's *Victory*, the *Nautilus* becomes locked in ice. This is not Arctic ice, it is Antarctic ice; and there is a marked difference between the two that Verne knew well. In *Great Explorers* Verne noted that the Antarctic ice J. C. Ross encountered “did not in any respect resemble that of the Arctic regions... It consisted of huge blocks, with regular and vertical walls, whilst the ice-fields, less compact than those of the north, move about in chaotic confusion, looking... like a heaving land, as they alternately break away from each other and reunite.” See Verne, *Great Explorers of the Nineteenth Century*, 353. According to Dodge, Ross would be the first to penetrate the Antarctic Pack, and, according to Verne's version of things, he would sail to a higher south latitude than any explorer up to that time. See Dodge, *The Polar Rosses*, 196.

²⁵⁹ Verne, *Twenty Thousand Leagues*, 312.

Despite sailing farther south than the *Erebus* and *Terror*, on the return voyage the *Nautilus* becomes locked in ice, recalling John Ross's *Victory*. But the *Nautilus* is not locked in Arctic ice, it is locked in Antarctic ice; there is a marked difference between the two that Verne understood well. In *Great Explorers* he mentioned that the Antarctic ice J. C. Ross encountered "did not in any respect resemble that of the Arctic regions... It consisted of huge blocks, with regular and vertical walls, whilst the ice-fields, less compact than those of the north, move about in chaotic confusion, looking... like a heaving land, as they alternately break away from each other and reunite."²⁶⁰ The younger Ross was first to penetrate the Antarctic Pack²⁶¹ and return; the elder Ross had heroically survived being icebound in the Arctic. By escaping Antarctic ice, Nemo and his ship surpass both Rosses.

When an inverting ice berg imprisons the *Nautilus* "in a veritable tunnel of ice"²⁶² Nemo's crew works frenetically to dig out; predictably, Verne's ship design saves them. They use the *Nautilus*'s pumps to superheat seawater and melt through the berg. Once free in the water, the *Nautilus* rams its way up through the polar pack, the way John Ross had originally envisioned the *Victory* doing, with the iron strength of its narwhal-tusk prow driven by its powerful *hélice*:

The pressure-gauge indicated that we were only twenty feet away from the surface. A mere sheet of ice separated us from the air. Could we not break it?

In any case, the *Nautilus* was going to try. I could feel it manœuvring into an oblique position, lowering its stern and lifting its prow... Then, pushed on by its powerful propeller, it ploughed up into the icefield like a formidable ram. It was breaking it up piece by piece, the *Nautilus* was withdrawing, then throwing itself at full speed against the field. The ice began to tear, and carrying through in a supreme thrust, it threw itself on to the icy surface, which it crushed under its weight.²⁶³

²⁶⁰ Verne, *Great Explorers of the Nineteenth Century*, 353.

²⁶¹ I.e., according to Dodge, for which see pg. 196.

²⁶² Verne, *Twenty Thousand Leagues*, 317.

²⁶³ Verne, *Twenty Thousand Leagues*, 328-329.

This is both a display of the wondrous power of the narwhal tusk, the ‘unicorn horn,’ and an image of a whale breaching: Nemo’s ship is not only superior to the ships of both Rosses, it is superior because it is biomimetic, allowing Nemo to reach even the farthest ends of the globe and return unscathed. Whereas J. C. Ross and his crew were the first to plow their way into the Antarctic pack, and traveled the farthest through it, Nemo and his crew travel farther and become the first to punch their way out of it from beneath.

Unlike his uncle, J. C. Ross brought his ships back safely, despite a couple of close calls which make for exciting reading but lie beyond the scope of my argument here. During his voyage, he anchored at Van Dieman’s Land and hosted then-governor John Franklin to a party aboard the ships. Franklin assumed command of the *Erebus* and *Terror* after J. C. Ross concluded his Antarctic expedition. Under orders to make another attempt at the Northwest Passage, Franklin had the ships refitted with boilers and propellers, steam engines being more reliable by that time. In 1845, Captain John Franklin and Commander Francis Crozier, august captain of the *Terror* under J. C. Ross, set sail, never to be seen again.

After a few years, several expeditions went in search; they found messages in stone cairns built by Franklin and his crew, artifacts from the expedition, and enough bodies to conclude that the expedition had perished in the harsh Arctic conditions. The investigation continues, fueled by the recent discoveries of the wrecks of the *Erebus* and *Terror*, but all current theories about the Franklin Expedition’s fate emphasize food scarcity. W. T. White blamed scurvy, based on the condition of three bodies discovered in 1852,²⁶⁴ and based on debris and

²⁶⁴ W[ilton T.] White, *Probable Fate of Sir John Franklin and Crew; or, The Scurvy in the Arctic Seas, and Correspondence of Captain W. White with the Lords of the Admiralty, and the Principal Commanding Officers of the Late Arctic Expeditions, on Its Prevention and Cure* (London, England: Piper Brothers and Co., 1852), 5.

human remains he found on Beechey Island and the Canadian mainland, John Rae concluded that Franklin's men resorted to cannibalism, a great scandal in Victorian England and a view that Verne himself popularized in *Hatteras*.²⁶⁵ Nearly a century later, new evidence suggested the symptoms of scurvy were actually lead poisoning from the sealant on the expedition's canned goods.²⁶⁶ In any case, polar explorers' accounts all concur that food scarcity was a constant problem in Arctic exploration, and even where hunting and fishing were possible, dry fuel for cooking was often unobtainable.

Verne recognized that, under these conditions, explorers needed a ship that could keep its crew warm and give them access to edible wildlife in the underwater depths: a "floating habitation."²⁶⁷ Nemo uses seawater to generate the *Nautilus*'s electricity, which heats the ship, and he and his crew eat solely from the ocean. Aronnax recounts dining on fillet that turns out to be turtle and on stewed pork that is actually dolphin liver. Nemo's table boasts "a sea slug jam that a Malay would declare without equal anywhere in the world," "a cream made from milk provided by whale's breasts," "sugar from the great wracks of the North Sea," and "anemone

²⁶⁵ John Rae, "The Fate of Sir John Franklin," *The Melancholy Fate of Sir John Franklin and His Party, As Disclosed in Dr. Rae's Report; Together with the Despatches and Letters of Captain McClure and Other Officers Employed in the Arctic Expedition* (London, England: John Betts, 1854), iv. See also Leslie's commentary on Rae's report in John Leslie, *Discovery and Adventure in the Polar Seas and Regions* (London, England: T. Nelson, 1860), 511. For the passage in which Verne repeated this theory, see Jules Verne, *The Adventures of Captain Hatteras*, ed. and trans. William Butcher (Oxford, England: Oxford University Press, 2005), 97-101.

In the years after its loss the Franklin Expedition sailed into the national legendarium of Canada, where it has stood for westward expansion and the grit of the earliest Canadians in settling the wild territory of Canada's interior. The Franklin Expedition's influence on literature and music could easily fill a bibliography, but here I will offer just a few references. For a Franklin-inspired ballad, see Stan Rogers, *Northwest Passage* (Dundas, ON, Canada: Fogerty's Cove Music, 1981). For Franklin-inspired poetry, see Edward Dorn, "Relics from a Polar Cairn," *Collected Poems* (Manchester, England: Carcanet Press Ltd., 2012), 5-7. For nonfiction on Franklin see Margaret Atwood, "To Beechey Island," *Writing with Intent: Essays, Reviews, Personal Prose, 1983-2005* (New York, NY: Avalon, 2005), 365-374; and also Margaret Atwood, "Introduction: *Frozen in Time: The Fate of the Franklin Expedition* [revised edition] by Owen Beattie and Jon Geiger" *Writing with Intent: Essays, Reviews, Personal Prose, 1983-2005* (New York, NY: Avalon, 2005), 375-381.

²⁶⁶ Atwood, "Introduction: *Frozen in Time*," 379.

²⁶⁷ Verne, *Twenty Thousand Leagues*, 55.

jam which is the equal of the most savoury fruits.”²⁶⁸ The ocean floor also caters to human pleasures, supplying a liquor extracted from waterleaf and a seaweed ‘tobacco’ for Nemo’s and his passengers’ after-dinner cigars.²⁶⁹ All of this is served luxuriously: Aronnax describes the ship’s table service, an echo of the few remnants of the Franklin Expedition that Rae discovered, as “elegant, and in perfect taste,” complete with monogrammed flatware and utensils.²⁷⁰

But the *Nautilus*’s provision is not limited to potables, comestibles, and recreational smokes: it is a fully-supplied, prosthetic habitat. Its name—the *Nautilus*—recalls the hull of the Burghley Neff and thus connotes a wondrous shell containing life-giving food, life-sustaining machinery, and scientific and artistic artifacts that express Nemo’s tastes and interests. There is a library aboard, curated by Nemo before he set sail.²⁷¹ The salon window affords hours of taxonomizing fun, the ship carries gear for subaquatic hunting and exploration, and Nemo occasionally plays music on the ship’s organ. As Verne imagined it, the ultimate ship would afford its captain, crew, and passengers what they needed to live off the sea, including a morale-sustaining quality of life: safe within Nemo’s shell, they are warm and comfortable, with lots to study and discuss. Because of these affordances, Nemo can abandon landed society and the submarine can sail imperviously into the maelstrom. It can be lost to human knowledge for as

²⁶⁸ Verne, *Twenty Thousand Leagues*, 67-68.

²⁶⁹ Verne, *Twenty Thousand Leagues*, 71, 103.

²⁷⁰ Verne, *Twenty Thousand Leagues*, 54. Doubtless, one of the grimmest aspects of John Rae’s account that the Franklin Expedition had succumbed to cannibalism was that monogrammed officers’ silverware constituted much of the material evidence that he had actually found Franklin’s crew’s remains. According to Rae’s report to the Secretary of the Admiralty, “From the mutilated state of many of the corpses and the contents of the kettles, it is evident that our wretched countrymen had been driven to the last resource—cannibalism—as a means of prolonging existence.” See John Rae, “The Fate of Sir John Franklin,” iv. Relevant excerpts from the journal Rae kept during the search included the following: “List of articles purchased from the Esquimaux, said to have been obtained at the place where the bodies of the persons reported to have died of famine were found... 1 silver table spoon—crest, with initials ‘F. R. M. C’ (Captain Crozier, *Terror*)... 1 round silver plate, engraved, ‘Sir John Franklin, K.C.B.’” See John Rae, “The Fate of Sir John Franklin,” v-vi.

²⁷¹ Verne, *Twenty Thousand Leagues*, 69-71.

long as its captain likes, leaving the rest of the world to wonder about his fate the way it wondered about John Franklin's; but it also leaves him the option of changing his mind and staging a miraculous return like John Ross's, like the return he makes in *The Mysterious Island*.

Verne's Design Theory

Thus far I have demonstrated that Verne's *Nautilus* was influenced by wonders and by the Royal Navy's polar exploration vessels. From this complex intersection emerged what I am calling the mechanimal trope, a literary vision of biomimetic vehicles and biorobots. The mechanimal's subsequent development indicates Verne saw a corporeity that combined natural and mechanical structures as essential to any effort to design a ship that could traverse the aerial element, as Robur's *Albatross* does in *Robur the Conqueror*, or all the elements, as Robur's *Terror* does in *Master of the World*. In fact, the elephant shape of Verne's machine in *The Steam House* suggests that he saw animal form as the essence of all good locomotive design.²⁷² As the earliest instance of the mechanimal trope, the *Nautilus* was therefore just the first iteration of a design theory Verne never named but which he used throughout his writing career.

Far more than a literary aesthetic, the conceptual model of wonder that Verne deployed in describing his vehicles is roughly equivalent to what Janine Benyus has recently popularized in her book *Biomimicry: Innovation Inspired by Nature*. Benyus's innovation rhetoric occludes the age of biomimicry, and her green utopianism evades its military and political applications, which become clearer when we recognize Verne's biomimetic design thinking. Biomimicry, Benyus says, "helps animals and plants blend into their surroundings, or... to take on the traits of a species that is better adapted to its environment. By mimicking nature's best and brightest, we,

²⁷² I am indebted to Alex Kirstukas for bringing this to my attention.

too, have a chance to blend in and become more like what we admire.”²⁷³ As Nemo and his *Nautilus* demonstrate, neither adaptation to one’s environment nor blending in within it is essentially good: both can be turned to violent purpose. The recent resurgence of interest in biomimicry should trouble us because Verne’s biomimetic designs were inspired not only by nature, but by works of art traditionally used to wield social and political power and by the ships at the vanguard of the largest nineteenth-century empire’s expansionism: biomimicry is not only older than Benyus’s work implies, it is also much more complicit in imperial agendas.

The Mechanimal Vision in Twentieth-Century America: Verne’s Legacy

Since I am focused on Verne as a designer, here I have read the mechanimal as Vernian biomimicry; however, it would be a mistake to reduce the mechanimal trope to biomimicry because it has contributed to many other representational economies as well. For example, the mechanimal trope is visible in the practice of representing machines as animal, what we might call “the animalization of machines,” a practice explicated by Nicole Shukin in *Animal Capital*. Among other animalizations, Shukin points out the animal onomastics of automobiles, as with the Mercury Cougar, the Buick Wildcat, the Ford Mustang, and others, in which she sees a process of rendering animal life. Through rendering, no part of the animal goes to waste; instead, when an animal body is reduced to its most basic elements, each can be repurposed within the logic of modern industrial capitalist production. This is no less true of animal form than it is of animal material. According to Shukin, “While automobiles were certainly fetishized as animal in early Fordist culture, animal metaphors proliferated in market discourses of the second half of the twentieth century as capital was increasingly diverted into the symbolic as

²⁷³ Janine M. Benyus, *Biomimicry: Innovation Inspired by Nature* (San Francisco, CA: HarperCollins, 1997), 296.

well as the material production of cars.”²⁷⁴ Ultimately, the practice of giving automobiles animal names derives from the onomastics of ships, such as the *HMS Beagle*, which became famous along with Darwin’s discoveries; after ships, airplanes were animalized, such as Louis Blériot’s *Libellule*, “Dragonfly,” an early prototype of the plane in which he later distinguished himself as first to fly across the English Channel. The convention intensified during World War II, as seen in Britain’s Fairey Fireflies and Barracudas, the United States’ P-51 Mustang, and Germany’s Focke Wulf Fw. 190, among others. All of these wartime animalizations suggest that the animal onomastics of automobiles with which Shukin is concerned are merely a postwar marketing gimmick aimed at returning American GIs for whom the animalization of machines had by then become common sense.²⁷⁵ Nor did the convention of animalizing machines wane after the World Wars, for during and since the Cold War the convention continued, as seen in the names of fighter jets such as the F-14 Tomcat, the F-15 Eagle, and the F-22 Raptor, and in the more general moniker “drones,” denoting the worker class of genus *hymenoptera*, which has emerged in the twenty-first-century.

In this chapter I have demonstrated that the automotive culture with which Shukin takes issue is part of a much longer modern history of animalizing machines, and that the U.S. inherited the convention from Europe. In Chapter IV I will trace this cultural transmission

²⁷⁴ Nicole Shukin, *Animal Capital: Rendering Life in Biopolitical Times* (Minneapolis, MN: University of Minnesota Press, 2009), 116.

²⁷⁵ Robert A. Fria, *Mustang Genesis: The Creation of the Pony Car*, foreword by Lee Iacocca (Jefferson, NC: McFarland & Company, Inc., 2010), 83. Fria dismisses as “a common misconception” the view “that Johnny Najjar named the [Mustang] after the World War II P-51 fighter plane named ‘Mustang.’” However, he goes on to quote Najjar, who admits that he suggested the name to his supervisor, R. H. Bob Maguire, after reading about the P-51. Maguire dismissed the name at first on the grounds that it was “too airplaney,” but then reconsidered when Najjar re-pitched it, “this time with a horse association because it seemed more romantic.” Fria’s conclusion, then, is oversimplified: obviously Najjar *had* been inspired by the P-51, and although Maguire only accepted the Mustang name on the grounds that associating it with a horse was more romantic, in this he showed his ignorance of a long history of onomastically animalizing machines.

through the writing of H. G. Wells, but it is relevant here because animalization of machines was common sense in American by the time the engineers who were influenced by Verne began working to realize machines he had imagined.

To some, the claim that Verne inspired twentieth-century American engineers may seem dubious. Can we seriously consider that what have long been viewed as yesteryear's science-influenced adventures for kids actually deployed a process of design thinking that has issued in some of the most destructive war materiel of the twentieth and twenty-first centuries? Although I do not believe Verne ever intended such a result, the historical evidence supports this view. To show exactly how, I want to return to the Butlerian taxonomic analysis I mentioned at the beginning of this chapter. C. Lloyd Morgan, whose work is quoted at the end of Chapter I, believed that "the evolution of machines is but the sign and outward manifestation of the evolution of certain activities of that highest known product of organic evolution, man... it testifies to the evolution of the [human] mind."²⁷⁶ Butler described this evolution; but Verne *exemplified* it by designing the ships that drove the adventures published as *Les Voyages Extraordinaires*. Moreover, Verne scholars have already established Verne's influence on several inventors of modern vehicles, including Octave Chanute and Igor Sikorsky.²⁷⁷

I contend that Norbert Wiener should also be included in this list, and in tracing Verne's influence on him here I show that Verne not only influenced modern aviation by imagining the aeronef in *Robur the Conqueror*, he also influenced modern biorobotics by imagining the

²⁷⁶ Morgan, 160.

²⁷⁷ Excellent work has been done on Verne's influence on these two inventors. See Alex Kirstukas, "Introduction," in Jules Verne, *Robur the Conqueror*, ed. Arthur B. Evans, trans. Alex Kirstukas (Middletown, CT: Wesleyan University Press, 2017), vii-ix. Kirstukas cites the research on Verne's influence on Sikorsky. Additionally, in correspondence he has generously pointed me to Sergei Sikorsky, *The Sikorsky Legacy: Images of Aviation* (Charleston, SC: Arcadia Publishing, 2007), 11. For a good explanation of Verne's influence on Chanute's imagination, see Simine Short, *Locomotive to Aeromotive: Octave Chanute and the Transportation Revolution* (Urbana, IL: University of Illinois Press, 2011), 185-186.

Nautilus. Therefore, the designs of modern vehicles can effectively be traced through Verne's stories and back to Renaissance wonders and the Royal Navy's ships through two different ships.

Robur's *Albatross* inspired both Chanute and Sikorsky, a fact which establishes Verne's influence on modern aviation, since Chanute was central to the development of aeroplane flight and Sikorsky invented the helicopter. One of the most remarkable features of the network of inventors working to develop a workable aeroplane was that it stretched around the globe and surmounted significant language and cultural barriers in a time before computers and the internet. Hard copies of letters, data charts, schematics, and the occasional photograph traveled between, among others, Louis Blériot and Alberto Santos-Dumont in France, Louis-Pierre Mouillard in Egypt, the Wright Brothers in the U.S., Lawrence Hargrave in Australia, and Otto Lilienthal in Germany. Octave Chanute, a French-born Chicago engineer, was a major hub in this network of correspondence, routing information from one thinker to others when he believed that sharing research might produce a workable heavier-than-air flying machine.

During the last quarter of the nineteenth century aviation's reputation shifted from a pipe dream pursued here and there by lunatics who were likely to kill themselves in the attempt, to a vision for humanity's technological and sociopolitical future. Chanute's gradual commitment to aviation research reflects this shift because, by then, he was a well-known engineer and could not afford to stake his reputation on what he initially believed was a fool's hope. Likely owing to several successes in flight in the 1880s,²⁷⁸ which made the possibility of human aviation seem more realistic, Chanute began experimenting with aeroplane models in 1888. While attending a meeting of the American Society of Civil Engineers in New York that year he bought a copy of

²⁷⁸ For a brief summary of these successes, see Charles H. Gibbs-Smith, *Aviation: An Historical Survey from its Origins to the end of World War II* (London, England: Her Majesty's Stationery Office, 1970), 52-57.

Verne's *The Clipper of the Clouds* (as *Robur the Conqueror* was known in the U.S.) in which he underlined the following passage: "Locomotives are not copied from the hare, nor are ships copied from the fish. To the first we have put wheels, which are not legs; to the second we have put screws, which are not fins. Besides, what is this mechanical movement in the flight of birds, whose action is so complex?"²⁷⁹ Verne's point was that "one must not slavishly imitate nature"²⁸⁰ in seeking to replicate animal locomotion.

Because Verne's *aeronef* in *Robur the Conqueror* more closely resembles a helicopter than an airplane, it comes as no surprise that it also influenced Igor Sikorsky, inventor of the first successful helicopter.²⁸¹ According to Sergei Sikorsky, Igor Sikorsky's son and biographer, in *Robur* Verne "described an imaginary helicopter capable of hovering while rescuing people in distress. It was probably young [Igor] Sikorsky's favorite book."²⁸² Sikorsky met Blériot and Ferber in Paris in 1909; on that occasion Ferber advised him: "Do not waste your time on a helicopter. The airplane will be far more valuable."²⁸³ Sikorsky disregarded the advice, notably because he believed in Verne's search-and-rescue vision for the *aeronef*, which the helicopter has certainly fulfilled. But however noble that vision, the helicopter has become an icon of

²⁷⁹ Simine Short, *Locomotive to Aeromotive: Octave Chanute and the Transportation Revolution* (Urbana, IL: University of Illinois Press, 2011), 185-186. For the passage in context, see Verne, *Robur the Conqueror*, 55.

²⁸⁰ Verne, *Robur the Conqueror*, 55.

²⁸¹ In 1862 d'Amecourt filed a patent with the London Patent Office in which he described a device that incorporated Cayley's *hélice* into the design for an "aerostatical apparatus (which I intend denominating *aeronef* or *helicoptere*): the earliest use of "aeronef" documented by the OED was associated with the helicopter. See Gustave Louie Marie Viscount de Ponton D'Amecourt, *Aerostatic Apparatus* (London, England: George Edward Eyre and William Spottiswoode, 1862), 1. This patent indicates that it was "sealed the 28th January 1862, and dated the 3rd August 1861." The first workable helicopter was invented by Étienne Œhmichen, a French entomologist; it flew in 1921. However, Œhmichen's design was not adopted or refined by later engineers. That distinction fell to Sikorsky—hence my description here: "inventor of the first *successful* helicopter."

²⁸² Sergei Sikorsky, *The Sikorsky Legacy: Images of Aviation* (Charleston, SC: Arcadia Publishing, 2007), 11.

²⁸³ Sikorsky, 9.

American imperialism, as in Francis Ford Coppola's *Apocalypse Now* or Ridley Scott's *Black Hawk Down*.²⁸⁴

Like the Royal Navy's ships, then, the airplane and the helicopter were each deployed as tools of both imperial exploration and military power in twentieth-century wars; and when they were brought into the military heraldry of the modern world's armed forces, both types of machines were animalized. I have already mentioned the animal onomastics of airplanes above. The onomastics of Sikorsky Aircraft's helicopters similarly evince the mechanimal trope's pervasive influence on human thinking about real vehicles: "UH-60 Black Hawk," "SH-60 Seahawk," "CH-53 Super Stallion," and, recalling the helicopter's technological ancestor, the ship, its literary roots in the romance tradition, and also Verne's conflation of the horse and the ship in *Hatteras*, "CH-64D Sea Knight." Even in the twenty-first century, both airplanes and helicopters, like Renaissance wonders, are used to evoke awe at imperial prowess: one need only attend one of the myriad air shows hosted in the United States each year to experience the technological sublime of the modern vehicle.

However, whereas Chanute and Sikorsky were influenced by Verne's design for Robur's *Albatross*, Norbert Wiener was influenced by the *Nautilus*. Surprisingly little has been said about Verne's influence on Wiener, even though the latter clearly acknowledged Verne's influence in both of his autobiographies. In *Ex-Prodigy: My Childhood and Youth* (1953), Wiener called Verne's *The Mysterious Island* and Wells's *The First Men in the Moon* "the two books which introduced me to science fiction. Indeed, for many years I remained an *aficionado* of Jules Verne, and a trip to the library to find yet another volume of his writing was probably a

²⁸⁴ Although the helicopters in *Apocalypse Now* were Bell UH-1 Iroquois, the helicopters in *Black Hawk Down* were Sikorsky UH-60 Black Hawks.

greater delight than this generation of children can get out of the movies.”²⁸⁵ He would acknowledge Verne’s influence again in *I Am a Mathematician: The Later Life of a Prodigy* (1956).²⁸⁶

Verne’s influence on Wiener’s thinking is apparent in at least three ways. First, both thinkers conflated organic life and mechanical movement in a rhetoric of design. Second, both saw biomimicry as essential to the designs of future machines, because—third—they both saw biomimicry as instrumental for realizing quicker, more precise human control of mechanical systems. During World War II, Wiener developed firing control systems for the guns on Allied warships.²⁸⁷ Through this work, he came to see large vehicles’ human crew members as organs, functionaries within larger mechanical systems: as “pilots and gunners... undifferentiated from the bombers and anti-aircraft units in which they fought.”²⁸⁸ While in some cases humans had to initiate mechanical processes, compared to machines they were relatively slow and seldom as precise. Many of Wiener’s contemporaries imagined what would later become the computer as an array of small machines that transferred signals mechanically, but Wiener realized it would be faster to send signals by switching current on and off. By doing this, he argued, mechanical processes could be almost instantaneously initiated, because electrical signals traveled faster than mechanical signals and once they were received they could be translated into efficient mechanical output.²⁸⁹ Wiener described the designs of such systems in neurological terms:

²⁸⁵ Norbert Wiener, *Ex-Prodigy: My Childhood and Youth* (New York, NY: Simon and Schuster, 1953), 84.

²⁸⁶ Wiener, *I Am a Mathematician*, 270.

²⁸⁷ The history of this research is well documented in Galison, “The Ontology of the Enemy.”

²⁸⁸ Galison, 251.

²⁸⁹ For a full account of this development, see Wiener, *I Am a Mathematician*, 264-268. Wiener traces his trajectory of thought, albeit in brief, from his research in feedback applications for firing control systems to his realization that the best model for computer circuitry was the nervous system.

“There is a certain analogy between a nerve fiber and a flip-flop electric circuit, an electric circuit with two, and only two, states of equilibrium. This analogy is so close that, long before the message reaches the end of the fiber, it carries its information in the form of a number of impulses rather than in the form of the strength of the impulse.”²⁹⁰ Over time, Wiener biomimetic design thinking helped the U.S. Navy realize the kind of control Nemo has over the *Nautilus*, which responds to him so well that Aronnax and company mistakenly suppose the crew to be electric.

This biomimetic design thinking and precise control was bound up in the word “cybernetics,” which Wiener coined to describe the research that began with the Macy Conferences held in New York starting in 1946.²⁹¹ This series of interdisciplinary conversations coalesced into a definable project that drew from psychology, anthropology, sociology, psychiatry, engineering, biology, and mathematics. According to Steve Heims, “the idea was to identify in a behaviorist spirit some of those aspects of what organisms do that can be analyzed in terms of what certain analogous machines do.”²⁹² As the purpose of the Macy Conferences became clearer, Wiener named the project “cybernetics,” a word derived from the Greek *kubernētēs*, which means both “helmsman” and “governor,”²⁹³ and defined the term as “the theory of communication and control in the machine and in the living organism,”²⁹⁴ thereby

²⁹⁰ Wiener, *I Am a Mathematician*, 268.

²⁹¹ Steve Joshua Heims, *The Cybernetics Group* (Cambridge, MA: The MIT Press, 1991), 11.

²⁹² Heims, 15.

²⁹³ Norbert Wiener, *The Human Use of Human Beings: Cybernetics and Society* (Boston, MA: Houghton Mifflin Company, 1954), 15.

²⁹⁴ Norbert Wiener, *I Am a Mathematician: The Later Life of a Prodigy* (Garden City, NY: Doubleday & Company, Inc., 1956), 269.

conflating mechanical and animal anatomy in design rhetoric.²⁹⁵

Once such control was established, vehicles could be automated for a variety of purposes. Wiener's research found a home at the Advanced Research Projects Agency (ARPA), which was renamed the Defense Advanced Research Projects Agency (DARPA); the latter funded a constellation of biomimetic machines that are visibly patterned after the bodies of animals. In the wake of, among other factors, Benyus's popularization of biomimicry and the development of better computer components, such as cameras, microphones, smaller and faster processors, etc., robotics researchers have been able to construct mechanical bodies that formally and locomotionally resemble animals.

The development of these corporeal biorobots follows Verne's elements-oriented design logic. Models developed for deployment on land, under water, and in the air have been patterned after species that move well in these environments. Boston Dynamics's now-infamous SpotMini, a canine robot reminiscent of Ray Bradbury's mechanical hound from *Fahrenheit 451*, will be sold to the general public for ground-based operations starting in 2020. Although its delivery, search-and-rescue, and industrial applications have been touted amid a preemptive marketing push, Bradbury's story and "Metalhead," an episode of Charlie Brooker's dystopic show *Black Mirror*, have renewed public concerns about the possible misuses of AI-powered canine robots. According to General Dynamics's website, the company's Bluefin UUV (unmanned underwater vehicle) line has been developed for shore and seafloor survey, scientific exploration, search and salvage, ship hull inspection, harbor security, surveillance and reconnaissance, mine countermeasures, and anti-submarine warfare applications, evincing the

²⁹⁵ Peter Galison, "The Ontology of the Enemy: Norbert Wiener and the Cybernetic Vision," *Critical Inquiry* 21:1 (Autumn 1994): 228-266; see pg. 245.

same admixture of scientific and military uses Verne imagined for Nemo's *Nautilus*. And this is to say nothing of the biomimetic aerial vehicles mentioned in the introduction, nor of DARPA's 2008 proposal for a flying submarine, a vehicle that can move through the air or underwater like Robur's *Terror*.²⁹⁶

The researchers working to to develop biorobots posture as technological visionaries and market their work with a thick veneer of wonder; to some extent this is a function of the international staging of fora such as TED Talks, which recapitulate the World's Fair environment by hosting technological demonstrations and broadcasting them to the internet. But some of the wonder results from choices made by individual presenters. For example, the titles of Raffaello d'Andrea's talks—"The Astounding Athletic Power of Quadcopters" and "Meet the Dazzling Flying Machines of the Future"—evinced a characteristically Vernian admixture of mechanicity and corporeity, couching it in a language of wondrous futurity. D'Andrea's curriculum vitae indicates a steady stream of United States federal funding from 1998 to 2007—the years leading up to and following the 9/11 attacks—that includes grants from DARPA, the Department of Defense, and the U.S. Air Force Office of Scientific Research, which is located at Wright-Patterson Air Force Base in Ohio, home to the Drone Aviary, which has been a hub of biomimetic robotics research.

The technological vision for these biorobotic realizations of the old mechanimal trope is a contemporary nuance of Verne's solutions to the problems that plagued Royal Navy exploration vessels. The fundamental premise of biorobotics is to remove the cumbersome human operator that Wiener sought to design around, which offers the added benefit of removing the risk of

²⁹⁶ The original page has since been deleted, but is referenced in Paul Marks, "From sea to sky: Submarines that fly," *NewScientist* (30 June 2010). <https://www.newscientist.com/article/mg20727671-000-from-sea-to-sky-submarines-that-fly/>.

losing a ship's crew to geospatial exploration or military operations. Smaller, lighter, faster, sustainably-powered craft that can be piloted remotely not only negate the human health risks of exploring in harsh conditions like the polar regions and render problems like food and heat sourcing entirely superfluous, they also have a better chance of navigating narrow passages through ice-choked polar seas, even as polar ice dissipates due to erratic changes in global climate. Moreover, machines like those from General Dynamics's Bluefin line are capable of geospatial, oceanographic, and photographic data collection that has rendered human expeditions all but obsolete. And furthermore, their increasingly convincing animal shapes and movements act as camouflage, concealing human-made devices in the forms of nonhuman species.

Verne, Wiener, and the Mechanimal's Place in a Global Imperial Vision

Beyond his literary influence, Verne's legacy amounts to a problematic convergence of the trajectories of (1) biorobotics, which has increasingly designed better-adapted, more mobile, more lifelike machines; (2) computing and sensor technologies, which are becoming smaller, faster, more energy-efficient, more portable, and more capable of gathering and storing ever-more-detailed information; and (3) technological discourse, characterized by researchers' and engineers' willingness to bypass their audiences' critical reflection on the significance of what they have designed by portraying their devices as wonders. We live in a time when, it seems, those at the helm of modern technological development are intent on reengineering all life.

Consider, for example, Galison's description of the progression of Wiener's philosophy of technology, which issued in a totalizing view of all materiality as inherently (re)designable:

the system of weaponry and people that Wiener had in mind was predicated on a picture of a particular kind of enemy. On the mechanized battlefield, the enemy was neither invisible nor irrational; this was an enemy at home in the world of strategy, tactics, and maneuver, all the while thoroughly inaccessible to us, separated by a gulf of distance, speed, and metal. It was a vision in which the enemy pilot was so merged with

machinery that (his) human-nonhuman status was blurred. In fighting this cybernetic enemy, Wiener and his team began to conceive of the Allied anti-aircraft operators as resembling the foe, and it was a short step from this elision of the human and the nonhuman in the ally to a blurring of the human-machine boundary in general. The servomechanical enemy became, in the cybernetic vision of the 1940s, the prototype for human physiology and, ultimately, for all human nature. Then, in a final move of totalization, Wiener vaulted cybernetics to a philosophy of nature, in which nature itself became an unknowable but passive opponent.²⁹⁷

Wiener's philosophy of nature was simply an extension of Verne's own totalizing view:

All then is now known, classed, catalogued, and labeled! Will the results of so much toil be buried in some carefully laid down atlas, to be sought only by professional *savants*? No! it is reserved to our use, and to develop the resources of the globe, conquered for us by our fathers at the cost of so much danger and fatigue. Our heritage is too grand to be relinquished. We have at our command all the facilities of modern science for surveying, clearing, and working our property. No more lands lying fallow, no more impassable deserts, no more useless streams, no more unfathomable seas, no more inaccessible mountains!

We suppress the obstacles nature throws in our way. [...]

This is our task and that of our contemporaries. Is it less grand than that of our predecessors, that it has not yet succeeded in inspiring any great writer of fiction?²⁹⁸

The fact is, this vision *did* inspire a great writer of fiction: Verne himself. And after him came several, including Greer and Wells, whose work I address below.

A century after the first mecha emerged, Wiener developed the technologies needed to accomplish the Vernian vision of rendering the entire globe productive. Among the casualties in this conquest have been nature, and also human nature—particularly the tendency to resist those who would wield power over us by dictating the plan for our environment. As C. S. Lewis so aptly pointed out, “what we call Man's power over Nature turns out to be a power exercised by some men over other men with Nature as its instrument.”²⁹⁹

²⁹⁷ Galison, 233.

²⁹⁸ Verne, *Great Explorers of the Nineteenth Century*, 378.

²⁹⁹ C. S. Lewis, *The Abolition of Man* (San Francisco, CA: HarperSanFrancisco, 2001), 55.

Chapter III: Mechanical Knowledge and the Mechanical Terror

...consider the fact that the world has not yet found an acceptable definition of what “terrorism” is. One country’s terrorist is too often another’s freedom fighter.

-Arundhati Roy, *The End of Imagination*

If asked to say in a single sentence and as few words as possible what, apart from its incommensurable achievements in the arts, the 20th century introduced into the history of civilization by way of singular and incomparable features, the response would emerge with three criteria. Anybody wanting to grasp the originality of the era has to consider: the practice of terrorism, the concept of product design, and environmental thinking. With the first, enemy interaction was established on a post-militaristic basis; with the second, functionalism was enabled to re-connect to the world of perception; and with the third, phenomena of life and knowledge became more profoundly linked than ever before. Taken together, all three mark an acceleration in “explication.” In other words: the revealing-inclusion of the background gives underlying manifest operations.

-Peter Sloterdijk, *Terror from the Air*

When Tom Greer’s scientific romance *A Modern Daedalus* was published in 1885, critics in England and the United States associated it with the stories of Jules Verne; and despite the burgeoning popularity of Verne’s scientific romances, critics took an unfavorable view of Greer’s. Central to the relationship between these two critical reactions are three kinds of knowledge I refer to here as “mechanical knowledge”: knowledge that gives an account of how to construct a mechanical; knowledge a mechanical offers, which amounts to a new perspective on the world; and knowledge that clarifies the mechanical’s true nature, that it is a machine and not the biological organism it appears to be. Although mechanical knowledge in these three senses appears in *Twenty Thousand Leagues*, Verne’s editor Hetzel specifically forbade him from working out its implications for any specific, then-current political situation. However, in this chapter I demonstrate that mechanical knowledge is inherently political, that Greer recognized that fact, and that, for this very reason, he imagined that future mechanicals would just as likely be terrors as wonders. In modern political discourse there is a tendency to associate terror with non-state-sanctioned political violence. Since Greer was writing on the heels of the Fenian Dynamite attacks on London in the early 1880s, it would be easy to read terror in *A*

Modern Daedalus in the commonly used sense of extra-national violence. Instead, here I follow Peter Sloterdijk's new materialist definition of terror, which emphasizes the role that knowledge, design, and environmental awareness play in attacks that do not specifically target the enemy's body as such, but rather the structural and environmental conditions of the enemy's body's ability to remain alive. Greer's mechanimals are terrors because they adeptly explicate—they gather information on the conditions of the enemy's body's life—while also affording a superior position from which to attack those conditions; as such, O'Halloran's mechanimal is a case-study in the terrorizing quality of mechanimal knowledge, thanks to Greer's politics. Moreover, Sloterdijk's definition of terror precludes a reading of Greer as the stereotypical Irish terrorist, because its materialism points not to a specific political status (state actor status versus non-state actor status, for instance), but to an ability to gather knowledge and to use it in attacking an enemy's living conditions. Defined this way, Greer's O'Halloran is recognizably a terrorist, but so are the British troops he is fighting. As a study in mechanimal knowledge, *A Modern Daedalus* reveals that the ability to build a mechanimal, the perspective mechanimals offer on the world, and the mechanimal's ability to preclude any knowledge of what it really is, are all integral to terror in Sloterdijk's sense. As such, the mechanimal is a terror-machine, born of the terror endemic to Anglo-Irish relations in the British Empire near the close of the nineteenth century.

Since *A Modern Daedalus* is not a well-known work, even among nineteenth-century literature scholars, it may help to begin with a plot summary. Greer's story is framed as a retrospective account of John O'Halloran, a bookish Irish inventor who unwittingly led an Irish rising that resulted in Home Rule. Born and raised on a farm in the North of Ireland, O'Halloran was educated at Queen's College in Belfast, where his knowledge of mathematics and physics

earned him a scholarship and an admirable reputation. Upon finishing his work at university, he returns home to his father's farm to discover his mother has died and his father and brothers are growing restless and revolutionary under the influences of "Russian Nihilism, of German Socialism, of the Italian Carbonari, [and] of the French Commune."²⁴⁸ Keeping to himself, O'Halloran works to realize his childhood dream of human flight. He invents a flying machine, a set of prosthetic wings, and secretly learns to fly.

While on a test flight one afternoon, on the road below him he spies a well-known landlord's agent who has just evicted several families from their farms, and also a sniper lying in ambush atop a hill a long distance off. Within moments, O'Halloran has become a witness of the agent's murder and the assassin's subsequent escape. He returns home, nervous. As he recounts the adventure to his father, his family becomes excited, until O'Halloran realizes his older brother, Dan, is not among them. An argument ensues in which O'Halloran's father rages about English landownership and evictions like the one O'Halloran has witness. But having been educated in the British system, O'Halloran objects: "I don't hate the English; I love and admire them."²⁴⁹ His wings are confiscated and he leaves home, both in rebellion against and a disgrace to his nationalist family which, he now realizes, has become involved with an Irish resistance that has developed in his absence.

He resorts to the company of old college friends in Letterkenny, unionists who bankroll his work as he replicates his prototype so that he can demonstrate it in London. They do not believe human flight is possible, but O'Halloran argues that the existence of flying birds is evidence to the contrary. While O'Halloran builds another set of wings his friends imagine the

²⁴⁸ Tom Greer, *A Modern Daedalus* (London, England: Griffith, Farran, Okeden & Welsh, 1885), 7.

²⁴⁹ Greer, 50.

ways the might be used for investigating and curtailing a recent rash of assassinations. When he demonstrates this new prototype, his friends are astonished. He flies off to London, intent on selling it on the open market.

Landing spectacularly atop the dome of St. Paul's in London, O'Halloran is not well received, for it incites mass panic in the streets. After four years of Fenian dynamite terrorism, a Tory government is in power and jingoism is at an all-time high. Londoners assume he is a new kind of dynamiter come to plant bombs atop the parapets of monuments and public buildings. O'Halloran attempts to clarify his intentions by publishing an account in a London newspaper, but this only invites further suspicion and makes Parliament aware of his existence. His editor arranges a meeting with the Home Secretary at Parliament; from there, O'Halloran is followed by government agents, who try to confiscate his wings. He takes to flight.

Meanwhile, in Ireland, the resistance to eviction has escalated to insurrection. Ever larger groups of soldiers are being defeated in skirmishes with Irish revolutionaries; the officers are always shot. In the aftermath of a riot over the Irish Question outside Parliament, the injured O'Halloran is recognized by the Home Secretary and imprisoned in the Clock Tower of St. Stephen's. While he convalesces from injuries he received during the riot, the Home Secretary offers increasingly large sums for his wings. It becomes apparent that the Tory government wants to prevent his flying machine from being sold on the open market, lest it upset the financial interests of the railways and shipping companies. Moreover, they have plans to use it to put down the Irish, whose insurrection has escalated to a full-scale revolution.

Offended at the way he has been mistreated by the English to whom he had been so loyal, O'Halloran refuses to sell. His younger brother Dick stages a tower escape reminiscent of the

medieval romance²⁵⁰ and the two abscond to Wales, where O'Halloran teaches Dick to fly. Now with two flying machines, they cross the Irish Sea to Dublin, where they set to work manufacturing wings and training a flying brigade. Leading this force, O'Halloran bombs Dublin Castle, the primary English fortification in the South of Ireland at this point, and sinks a British ironclad in Dublin Bay. He is traumatized by the carnage, but he realizes that since he is killing at a distance it could be much worse. At the climax of his adventures, O'Halloran's flying brigade bombs a British expeditionary force into surrender, uniting Ulster with the rest of Ireland and establishing Home Rule. Only after this does he attain the peace and quiet he has long desired, and the freedom to visit friends far away by traveling on the wing; but the price of peace is the trauma that haunts him.

A Modern Daedalus's Historical Context and Critical Reception

When it was published, advertisers and critics generally described *A Modern Daedalus* as romance.²⁵¹ This characterization neatly harmonizes with D'Israeli's third example of scientific romance mentioned in the introduction: the type of story in which "men would as commonly call for their wings, as they did for their boots."²⁵² By inventing wings and liberating his people, O'Halloran plays the scientist-hero as defined by Gill.²⁵³

²⁵⁰ I read this episode as a recapitulation of what might be called the "escape-from-the-tower" trope in the medieval English romance. It implies the excitement of Robin Hood's daring escapes, or of Uther's abduction (rescue?) of Ygerne from the tower of Tintagel in the Arthurian legend.

²⁵¹ A search for Greer's name and the title of his book on HathiTrust reveals myriad advertisements and book reviews that describe it as a "romance" and mention associated tropes and conventions. Among the advertisements can be found references to *A Modern Daedalus* as "a startling and sensational romance," "a startling romance of the future," and "a sensational romance." See, respectively, *Truth* 17:432 (9 April 1885): 586; *The Bookseller* (5 May 1885): 400; and *The Academy* 27:669 (28 February 1885): 150.

²⁵² D'Israeli, *Vaurien*, 87-88.

²⁵³ Gill, *Scientific Romances of H. G. Wells*, 28.

The initial critical response to *A Modern Daedalus* indicates that reviewers recognized Greer was writing romance of the sort popularized by Jules Verne, but overall Greer's story was received unfavorably, for two reasons. First, the preface of *A Modern Daedalus* seemed to contradict its plot. In the preface Greer intimated that "though a native of Ireland, I am a lover of England, and a believer in the necessity of a firm and lasting union between the two countries... For the objects, and still more for the methods of the so-called 'dynamite party,' [i.e., the Fenians] I have the deepest abhorrence."²⁵⁴ Moreover, he insisted that "The incidents of this story are purely imaginary; but the ideas and forces with which it deals are real, and may at any moment be brought into active play by the inevitable development of the 'resources of civilization.'"²⁵⁵ By the late nineteenth century, Ireland's relationship with the British Empire had been complicated by the Great Famine, increasing English ownership of Irish land, the intrusion and objectification intrinsic to the Ordnance Survey, mass conscription and transportation to foreign wars, the introduction of English in an attempt to wipe out colloquial use of Gaelic through public education, and the issue of Home Rule, to name a few—in sum, the relationship was complicated by Britain's thorough and systematic colonization of Ireland. According to a short biography published in 1919, Greer was a surgeon, scientifically educated at Queen's College in Belfast, and also politically aware and active, a "member of a well-known Ulster family"²⁵⁶ who ran for Parliament as a Home Rule candidate. Greer's biography explains the dissonance between the story's preface and plot, a result of the distance between his Anglo-Irish, upper-middle-class identity and his cultural surroundings, marred by the poverty of many

²⁵⁴ Greer, v.

²⁵⁵ Greer, vi.

²⁵⁶ Stephen J. Brown, *Ireland in Fiction: A Guide to Irish Novels, Tales, Romances, and Folk-lore* (Dublin, Ireland: Maunsel and Company, Ltd., 1919), 119. Note that, in this case, *A Modern Daedalus* appears in a book about, Irish literature that includes, among other things, the romance.

Irish and their mistreatment at the hands of the English. From his own privileged experience, Greer recognized the benefits of imperial governance and social order, but as an Irishman he was all too aware of the way that order had disenfranchised those of his countrymen who resisted it.

Greer's genre choices also troubled critics, for his story is steeped in a Romanticism that still carried revolutionary undertones during the Victorian period. The title of *A Modern Daedalus* obviously alludes to Mary Shelley's *Frankenstein; or, The Modern Prometheus*. Moreover, the book regularly deploys sublime views of nature, frames O'Halloran as a devil *a la* the Byronic hero, and reads as the Irish rural speaking back to the London metropolitan. Amid the Fenian dynamite attacks on London in the early 1880s, these undertones would have inspired suspicion, if not fear. Most of all, *A Modern Daedalus* holds out hope that flight will usher in a utopian universal brotherhood of all humankind by mitigating the natural obstacles, such as the English Channel and the Irish Sea, that have historically separated nations. Amid the troubled Anglo-Irish relations of the late-mid-nineteenth century, it is difficult to believe that critics would not have reacted negatively to the author's *ethos* and the book's literary form, particularly given the story's vision of an Irish Rising. "As if the dynamite scare was not enough affliction for the British heart," one reviewer wrote, "the author of this book has provided a further horror in an imaginary autobiography of an Irishman who, having successfully taken to himself wings, organizes an aerial regiment of patriots for dropping explosives on the heads of Ireland's enemies,"²⁵⁷ i.e. the English.

Partly because of the Fenian attacks, but owing also to war on the Continent, 1880s London was an acutely xenophobic environment; and the scientific romance had the wherewithal to play upon the imperial center's fears of what lay beyond the nation's borders. Since George

²⁵⁷ *The Bookseller* (4 April 1885): 346.

Chesney's 1871 book, *The Battle of Dorking*, it had become easier to imagine that England might be invaded. But as I. F. Clarke noted, because Chesney's book was published on the heels of the Franco-German War of 1870, the fearful British gaze had turned toward the Continent.²⁵⁸ By contrast, English readers interpreted *A Modern Daedalus* to mean that the real danger was geographically 'behind' England, in Ireland. It is difficult *not* to surmise that Greer thought that Ireland had surpassed England scientifically and militarily, owing largely to British education and conscription. Moreover, *A Modern Daedalus* itself was evidence that at least one Irishman had the imagination to suppose that England was assailable and offered a vision of how one of its closest neighbors might be wrested from Parliament's political control with the help of knowledge that Britain was powerless to restrict; more on this below.

If Chesney's writing stoked English fear, by the mid-1880s Verne was one target of the fear Chesney had incited. More than one of Greer's reviewers associated *A Modern Daedalus* with Verne's stories, which by then had become popular in Britain and the United States; however, this was apparently not intended as a compliment. While descriptions of *A Modern Daedalus* as "a kind of Jules Verne book"²⁵⁹ or "a chapter out of some companion volume to *Twenty Thousand Leagues Under the Sea*"²⁶⁰ might sound benign or even favorable now, given Verne's longstanding popularity, when read against the historical context of London in the 1880s and of a broader critical response to *A Modern Daedalus* these comments suggest that even Verne himself had become a target of xenophobic suspicion. For example, one critic wrote of *A Modern Daedalus* that "the interest flags somewhat in the last chapters, where the campaigns of

²⁵⁸ I. F. Clarke, "Before and After *The Battle of Dorking*," *Science Fiction Studies* 24:1 (March 1997). <https://www.depauw.edu/sfs/backissues/71/clarke71art.htm>

²⁵⁹ "New Books," *The American Bookseller* 17:8: 234.

²⁶⁰ C. E. Dawkins, "New Novels," *The Academy* 27:674 (4 April 1885): 237-239. See pgs. 238-239.

the aërial dynamite brigade provoke and suffer from comparison with the efforts of Jules Verne.”²⁶¹ Given the explicit mention of *Twenty Thousand Leagues*, this denigrative reference to Verne reads as a reaction against the iconoclasm of Captain Nemo, who attacked ships, which were the foundation of Britain’s empire and economy at the time. Here we see a variation of Butler’s corporeal-evolutionary theory of machines in which the ship is construed as British because a result of British ingenuity. Moreover, by then the ship had a long English history as a political and literary symbol, evident in phrases like, “the ship of state.” Butler’s, Verne’s, and Greer’s bodily descriptions of vehicles conflated the ship and the body, with the curious result that readers in an increasingly jingoist Victorian England could misread an attack on a ship as an attack on the ship of state, the British imperial body politic.

When Verne wrote *Twenty Thousand Leagues* his editor, Hetzel, forbade him from identifying Nemo’s nationality or race in order to avoid political controversy. By contrast, Greer’s editor apparently shared none of Hetzel’s reservations, leaving Greer free to point out the possible political implications of colonized people’s access to mechanimal knowledge.

However, since Greer seemed to be imitating Verne, the latter took the blame. Critical backlash against *A Modern Daedalus* is easily explained as an extension of this anti-Verne sentiment:

whereas Verne imagined a mechanimal submarine that attacks Britain’s ships,²⁶² Greer imagined a mechanimal flying-machine that terrorizes London and attacks British ships and troops. A

²⁶¹ “Our Library Table,” *The Academy* 27 (28 March 1885): 406.

²⁶² *Twenty Thousand Leagues* begins with several accounts of modern nations’ encounters with the sea monster, which we discover later are really accounts of attacks staged by Nemo and his submarine. Among these, Verne imagined no fewer than six attacks on British ships, including “the steamship *Governor Higginson*, of the Calcutta and Burma Steam Navigation Company,” “the *Cristóbal Colón* of the West India and Pacific Steamship Co.,” “the *Shannon* of the Royal Mail,” “the *Etna* of the Inman Line,” “the *Moravian* of the Montreal Ocean Company,” and the *Scotia* of the British-American Cunard Line. See Verne, *Twenty Thousand Leagues*, 6-10.

scientific romance depicting a terrifying new aerial iteration of those attacks,²⁶³ written by an Irishman who professed his love of England, was thus understandably difficult to decipher.

Furthermore, the problem of how to read a story so framed was exacerbated by English and American readers' often-low view of the Irish. For example, American reviews aimed invective at Greer himself: "'Tom Greer' (we know not whether it is the author's real name or a *nom de plume*) evidently revels in fictive descriptions of English discomfort"—a trope Verne's and Greer's stories share—"by Irish prowess, but the moral of his book really is—quite contrary to his intention, we suspect—that an Irish rebellion has no chance of success until by some miracle the Irish should become possessed of the power of flight, of flight, too, of a kind with which no former rebellion has familiarized them."²⁶⁴ In this critic's view, if one takes *A Modern Daedalus* seriously, then its Irish authorship is an open question since, clearly, no Irishman could have imagined something so fell; but one need not take it seriously since it is merely the wood-headed ravings of an Irish mind. Another review resorted to more overtly racist insinuations—"The timid will comfort themselves with remembering that there are certain marked peculiarities in the Irish character which will prevent them from combining and winning success in the obvious way suggested"²⁶⁵—reassuring xenophobic American readers with Paddywhackery and the narrative of a backward Ireland, both of which had gained cultural cachet as Irish immigrated to the U.S. amid the Great Famine.

²⁶³ For a reading of *A Modern Daedalus* that more fully considers this history of Fenian terrorism, see Kathryn Conrad, "Infernal Machines: Weapons, Media, and the Networked Modernism of Tom Greer and James Joyce," *Science, Technology, and Irish Modernism*, eds. Kathryn Conrad, Cólín Parsons, and Julie McCormick Weng (Syracuse, NY: Syracuse University Press, 2019).

²⁶⁴ *The Westminster Review* 68: (July and October 1885): 304. The *nom de plume* supposition is interesting here: did this critic think this really was a work written by Jules Verne?

²⁶⁵ *The Nation* 40:1043 (25 June 1885): 526.

At least some of the invective that framed the Irish as insane arose from the fact that late-nineteenth-century aviators were generally viewed with ridicule and suspicion. Louis-Pierre Mouillard noted that many who, like him, researched aviation, “either through pride or through timidity, have withdrawn themselves from human intercourse, and have found themselves paralyzed by attempting to carry on their experiments in secret. They quickly found themselves so cavalierly classed as dreamers or as lunatics that they were compelled, under pains of complete discredit, to conceal from others this so-considered flaw in their intellect.”²⁶⁶ However, during the last quarter of the century public demonstrations of aviation proliferated. While many demonstrations featured balloons or even dirigible aerostats, which were relatively safe and common enough that ballooning clubs and facilities had been built by the 1880s, more ornithic flying-machines, such as those Greer imagined, had become infamous thanks to public demonstration. One of the latest and most lurid of these, Franz Reichelt’s 1912 demonstration of a parachute-like gliding suit at the Eiffel Tower, was captured as a moving picture.²⁶⁷ To the extent we read the author as a designer, as I have suggested in chapter two, the ridicule and suspicion Greer incurred, normally reserved for aviators like Reichelt, reads as a Victorian moral objection to the insanity of the technological vision of human flight.

Finally, it bears mentioning that even in Ireland *A Modern Daedalus* was received with reservations. Despite generally positive comments, a writer for *The Dublin Review* concluded that “The story is told with considerable spirit, but we have not much belief in the judiciousness

²⁶⁶ L. P. Mouillard, *The Empire of the Air: An Ornithological Essay on the Flight of Birds* (Paris, France: Octavo, 1888), 397.

²⁶⁷ British Pathé, “Death Jump off The Eiffel Tower: Paris, France (1912),” *YouTube* 13 April 2014. See <https://www.youtube.com/watch?v=e6YGLpzN7bE>.

of writing such narratives.”²⁶⁸ Such a caveat bespeaks concerns about the book’s incendiary politics, which could easily be interpreted as a provocation amid Fenian dynamite attacks and Victorian jingoism, or perhaps about the ways its focus on aviation exuded the caricature of the insane Irishman,²⁶⁹ which did little to help the cause of Home Rule. Whatever the reason, the column in *The Dublin Review* exuded a broader critical sense that Greer was speaking out of turn, that imagining an Irish flying-machine was politically and socially incendiary, and that by writing a story like this he risked sparking needless conflict.

Greer in Recent Literary Scholarship

A Modern Daedalus received scholarly attention in two discernable waves. The first wave of scholars to read Greer were preoccupied with him as an ostensible influence on James Joyce and his character Stephen Dedalus in *Portrait of the Artist as a Young Man*. Although Patrick Parrinder dismissed this theory early on,²⁷⁰ Giorgio Melchiori later speculated that *A Modern Daedalus*’s cover might have inspired Joyce but offered no historical evidence indicating that it actually had.²⁷¹ More recently, Brian Richardson perpetuated the Joyce-oriented first-wave view of Greer when he mentioned *A Modern Daedalus* in passing as a “novel of the period” that

²⁶⁸ H. W., “*A Modern Daedalus*. By Tom Greer. London: Griffith & Co. 1885.” *The Dublin Review* 14:97 (July-October 1885): 235.

²⁶⁹ The most comprehensive work on Hudy McGuigan is Hugh Harkin, *The Life and Adventures of Hudy McGuigan* (Draperstown, Ireland: Ballinascreen Historical Society, 1993). For a shorter—and delightful—version of the legend, see Jimmy McEldowney’s live storytelling: Ladybythetrack, “The Ballad of Hudy McGuigan by Jimmy McEldowney,” *YouTube* 19 April 2010. See <https://www.youtube.com/watch?v=lQInde84ZYU>.

²⁷⁰ Patrick Parrinder, *James Joyce* (Cambridge, England: Cambridge University Press, 1984), 31.

²⁷¹ Giorgio Melchiori, “The Languages of Joyce,” *The Languages of Joyce: Selected Papers from the 11th International James Joyce Symposium*, eds. Rosa Maria Bollettieri Bosinelli, Carla Marengo Vaglio, and Christine van Boheemen (Amsterdam, Netherlands: John Benjamins Publishing, 1992), 13.

contained everyday characters and scientific discoveries, a combination in which he was interested, specifically with regard to Joyce.²⁷²

R. B. Kershner's work on Greer was unique in that it partook of the Joycean interests of the first wave but left open the question of whether Greer had influenced Joyce, calling *A Modern Daedalus* "a politically revolutionary fable that may in fact have inspired Joyce in choosing his early pseudonym, but which, whether or not it was known to Joyce, has immense relevance to the image of his protagonist," i.e., Stephen Dedalus.²⁷³ Although Kershner went on to compare Greer's and Joyce's protagonists, in the process he also made observations that have become central to thinking about the text since then. First, he noted that *A Modern Daedalus* "does forcefully and schematically portray the situation of the Irish intellectual caught between his own spiritual, mystical, or even scientific aspirations and the call of nationalism," thereby hinting at the issue of O'Halloran's identity, which was later raised by Fennell. Second, Kershner recognized the connection between identity and politics but ungenerously charged that "Greer's book does not face squarely the issues it raises; instead it embraces Irish revolutionary ideology, wherein the liberation of the country more or less automatically resolves all other conflicts,"²⁷⁴ thereby foreclosing readings that see in *A Modern Daedalus* a less-than-tidy

²⁷² Brian Richardson, "The Genealogies of 'Ulysses,' the Invention of Postmodernism, and the Narratives of Literary History," *ELH* 67:4 (Winter 2000): 1035-1054, especially page 1048. A nearly identical passage also appears in Brian Richardson, "Make it Old: Lucian's 'A True Story', Joyce's 'Ulysses', and Homeric Patterns in Ancient Fiction," *Comparative Literature Studies* 37:4 (2000): 371-386; see page 378. One has the sense that first-wave Greer scholars were so enamored with the mere possibility that Greer's story might be some Ur-text for Joyce's *Portrait* or, in Richardson's case, *Ulysses*, that they paid less attention to the genre and formalist terms they used to describe *A Modern Daedalus*. Arguably, it is a "novel"; it is difficult to recognize in it the "fable"

²⁷³ R. B. Kershner, *Joyce, Bakhtin, and Popular Literature: Chronicles of Disorder* (Chapel Hill, NC: University of North Carolina Press, 1989), 190-191.

²⁷⁴ Kershner, 194.

ending.²⁷⁵ It is worth noting that Kershner's serious literary treatment of the book did much to pique scholarly interest.

As Jack Fennell has recently noted, this focus on Joyce has led scholars to overlook one of the most interesting facets of the story: O'Halloran's hybrid identity, an autobiographical reflection of Greer's own, resulting from his "socio-economic position as a middle-class professional Irishman, financially secure in a time when most of his countrymen were not, schooled by a British education system, a would-be participant in the British political establishment, and yet trying to retain an Irish identity."²⁷⁶ Fennell's assumption that O'Halloran's hybrid identity reflects Greer's suggest the value of bringing Greer's identity to bear on the complicated relationship between the preface and plot of *A Modern Daedalus*. As Fennell sees it—and I concur—Greer's hybrid identity explains how he could bear England no ill will but still offer a scathing critique of the way the Irish had been treated up to that point in the nineteenth century.

This focus on Anglo-Irish identity reveals an important difference between *A Modern Daedalus* and *Twenty Thousand Leagues* that its first critics overlooked: whereas Verne was writing scientific romances in order to popularize science, to imagine future machines, and to entertain his readers with scientific wonders, Greer was writing to point out that the Irish were as scientifically literate as the English and were therefore capable of developing the technologies that might wrest from Parliament the Home Rule that Ireland had so long been denied. Below I map the implications of this reading, which owes much to the research of Kathryn Conrad, who situates *A Modern Daedalus* in the immediate context of the Fenian dynamite attacks on early-

²⁷⁵ For example, I could see a reading informed by trauma theory questioning this conclusion of Kershner's, for by story's end O'Halloran's trauma remains unresolved.

²⁷⁶ Jack Fennell, *Irish Science Fiction* (Liverpool, England: Liverpool University Press, 2014), 78.

1880s London. Conrad attempts to define “the connections between the technologies of communication and the technologies of destruction.”²⁷⁷ To this end, she suggests that “we might consider the possibility that weapons technologies did not just mature alongside or make use of print; they provided an alternative *medium* of expression, a different form of address, to the same public, and in so doing, shaped the public to which they were addressed and the ‘mental map’ that they shared.”²⁷⁸ As such, her approach and mine both recognize that discourse and technology both contributed to violence in the context of England’s and Ireland’s troubled relationship at the end of the nineteenth century.

Mechanical Knowledge and its Politics in *A Modern Daedalus*

Relevant to Conrad’s notion of a shared, public mental map is what I am calling “mechanical knowledge,” a term I use here in three senses: the knowledge required to construct a working mechanical body; the knowledge a mechanical body affords its pilot; and the knowledge that a body in our environment is a mechanical and not the animal it appears to be. *A Modern Daedalus* directly addresses mechanical knowledge in the first two senses, and implicitly addresses mechanical knowledge in the third sense, which by then had already been raised more overtly by Verne in *Twenty Thousand Leagues*. Mechanical knowledge raises two important questions. First, what information does a shared, public mental map include? Second, who has access to this shared, public mental map, both to understand or “read” it and to construct or “write” it? For the sake of clarity, here I start by pointing out examples of mechanical knowledge in *A Modern Daedalus*, then demonstrate its inherently political nature and discuss how such politics affected the way Victorian England received *A Modern Daedalus*.

²⁷⁷ Conrad, 82.

²⁷⁸ Conrad, 82. Emphasis here is Conrad’s.

In *A Modern Daedalus* mechanimal knowledge in the first sense, the knowledge required to construct a working mechanimal body, comes from a combination of O'Halloran's personal ingenuity, his British scientific education, and his Irish cultural identity. O'Halloran recounts "the wonder and interest" with which he watched "the gliding flight of the sea birds" as a boy, which led to one of his first prototypes.

One of my earliest efforts in experimental mechanics was the construction of a kite from the stiffened skin and wings of a gull which had been shot by my father. This, by means of an ingenious combination of cords, I was able to control and guide through the air at the greatest height to which my ball of twine would reach.²⁷⁹

To make O'Halloran's prosthesis imaginable and believable to his readers, Greer reiterated a common argument from anatomy we might call "the argument from sparrows." One application of nineteenth-century anatomical research was developing new modes of movement based on studies of animal locomotion. As such, different versions of the argument from sparrows appear throughout nineteenth-century anatomical research working toward aviation, aerial navigation, and aerial locomotion.²⁸⁰ While the name of the bird changed depending on who was making the argument and what species of bird they deemed the best model for a flying-

²⁷⁹ Greer, 2.

²⁸⁰ For example, Pettigrew argued that "If there were no flying things—if there were no insects, bats, or birds as models, artificial flight... might well be regarded as an impossibility. As, however, the flying creatures are legion, both as regards number, size, and pattern, and as the bodies of all are not only manifestly heavier than the air, but are composed of hard and soft parts, similar in all respects to those composing the bodies of the other members of the animal kingdom, we are challenged to imitate the movements of the insect, bat, and bird in the air, as we have already imitated the movements of the quadruped on the land and the fish in the water." See James Bell Pettigrew, *Animal Locomotion; or, Walking, Swimming, and Flying, with a Dissertation on Aëronautics* (London, England: H. S. King & Co., 1873), 2-3. Louis-Pierre Mouillard, who studied soaring birds in Egypt, nuanced the argument somewhat by noting that observers in Europe were "confined to the bad examples which are found in their locality. They can only study the flapping birds—the pigeons, the bats, the little insects even. What good is to be got from studying a model which can not be imitated on a larger scale? It is impossible to reproduce an insect, a sparrow, even a pigeon, upon proportions which will carry a man. No material will bear the strains of wing beats as energetic as those of the sparrow. Steel itself is too weak in proportion to weight. Common sense indicates that the weak can only aspire to light tasks. Which then are the birds that expend the least energy? They are clearly the soaring birds, sweeping over great distances, by the sole power of the wind." Based on his observations, he suggested that vultures made particularly apt models for soaring flight. See Mouillard, 402-403.

machine, the argument was essentially the same in all cases: “Flight (without a gas-filled envelope) is possible, because Species X does it.” In Greer’s case, Species X was the sparrow: “‘On the contrary,’ said [O’Halloran], ‘[mechanical flight’s] possibility is demonstrated by every sparrow that flies across the road. The very same atmospheric and mechanical difficulties exist in the case of the sparrow, and it is for man to find out how they are overcome, and apply the same principles to his own case. That is what I have done.’”²⁸¹ O’Halloran’s deployment of the argument from sparrows functions as a kind of shibboleth among the scientifically educated. He is well-read enough in animal locomotion to argue for the usefulness of specific species of birds—gulls and sparrows—as models for a flying-machine.

According to the story’s logic, O’Halloran’s knowledge of how to make a mechanical flying-machine is at least partially the result of his hybrid identity. “So early did the idea of rivalling the flight of the birds take possession of my mind, and so greatly was it intensified and nurtured by the surroundings amid which my boyhood and youth were spent, that the history of my invention, if traced from its first inception and followed through all the different phases of its development, would be almost a history of my life.”²⁸² As he sees it, Ireland itself is part of the formula for flight, an idea that makes sense now since the winds at Kittyhawk figured prominently in the Wrights’ successful flight tests. But O’Halloran’s description here leaves unclear whether he attributes his success to Ireland’s environmental conditions, or to its cultural environment, a non-scientific, non-rationalist cultural milieu marked by a belief in magic and myth. Since aviation was popularly believed to be impossible, aviators’ continued quest for human flight was generally construed as a sign of madness, or at the very least, of indignity; and

²⁸¹ Greer, 59.

²⁸² Greer, A. For some reason the first page of Chapter I is paginated “A.”

since the insanity or indignity of attempting to fly was beneath the class of most of England's best-educated minds, then regardless of the inherent English intelligence or inventiveness that Butler had theorized, English social order, characterized by classism and imperial politics, was stacked against the possibility that an Englishman would be the first aviator. By contrast, the Irish, who by then had long been constructed as insane or as animal in English discourse, had less to lose by attempting such experiments; in fact, an Irish attempt to fly might be read as a postcolonial rejoinder to English characterizations of the Irish as animal or insane. In any case, while it might have been socially off-beat for O'Halloran to turn a dead gull into a kite and from there to develop a hang-glider-esque pair of prosthetic wings, in doing so he demonstrates the liberty of his imagination, which sees beyond present realities to the potential of things.

In *A Modern Daedalus*, mechanimal knowledge, in the sense of the knowledge a mechanimal body affords its pilot, can usually be traced to the aerial view, alternately known as the bird's-eye or God's-eye view, that his flying-machine affords.

I followed the windings of a coast spread like a coloured chart below me. The historic towers of Londonderry, the picturesque shores of Magilligan and Protrush, the beetling precipices of Fair Head, dwarfed into flatness by the height from which I viewed them, passed under me like the gliding of a river; the wild coast of Antrim, the cloud of smoke that hid Belfast, the fertile fields of Down and Meath and Dublin, the lovely hills and glens of Wicklow, the rich vales of Waterford and Cork, the gleaming lakes of Kerry, the broad estuary of the Shannon, the towering cliffs of Clare, the island-studded waters of Galway and Mayo, chased each other beneath me like figures in a dream—such a panorama as scarce another land could show!²⁸³

Greer's reference to cartography bespeaks the scientific and political values of nineteenth-century Britain, for the view from above was characteristic of the imperial maps and charts compiled by the Ordnance Survey, which focused intently on Ireland, and to which, not

²⁸³ Greer, 17-18.

coincidentally, Edward Sabine and James Clark Ross had been important contributors in between polar excursions.

At the time, cartographic survey by triangulation was a cutting-edge geographical research method, yielding knowledge that was becoming a boon to political administration. But the aerial view held even greater promise. Verne's friend Nadar, who is generally recognized as the first aerial photographer, believed the view from above would be essential to future society: "No more preliminary triangulation, painfully built up on a stack of trigonometric formulas; no more instruments, plan tables, compasses, alidades, graphometers... No more of these uncertain works, prepared without uniformity, pursued and completed by approximation, without cohesion, without control or guarantee, by unsupervised personnel."²⁸⁴ According to Nadar, photographing the land from above made then-current methods of cartography—many of which were the same methods used by Sabine and J. C. Ross—obsolete.

The way *A Modern Daedalus* portrayed mechanimal knowledge in the first two senses accounts for Greer's earliest critics' mixed sarcasm and alarm because mechanimal knowledge explicates, in Peter Sloterdijk's sense of the term. Sloterdijk has defined "explication" as "the revealing-inclusion of the background givens underlying manifest operations,"²⁸⁵ which he sees as intrinsic to modern warfare. He nuances it further as the historical intersection of the practice of terrorism in which "enemy interaction was established on a post-militaristic basis," of the concept of product design, which reconnected function with perception, and of environmental thinking that connected knowledge with the phenomena of life.²⁸⁶ In other words, modern

²⁸⁴ Nadar, 60.

²⁸⁵ Peter Sloterdijk, *Terror from the Air*, trans. Amy Patton and Steve Corcoran (Los Angeles, CA: Semiotext(e), 2009), 9.

²⁸⁶ Sloterdijk, 9.

warfare, which included acts of knowing and the violence of which accounted for what was known, marked the intersection of: (1) a willingness to assault one's enemies apart from any consideration of state sanctions or rules of engagement, (2) technologies whose designs incorporated both ways of knowing about and means of undermining enemy bodies' optimal functioning, and (3) an awareness of the environment's usability, either for assaulting enemies unexpectedly or for making available technologies work advantageously.

My terminology here, "mechanimal knowledge," emphasizes the extent to which explication is entwined with a multivalent body politics. In the first sense, "mechanimal knowledge" describes an explicative perspective on animal bodies taken by anatomists, which became the pattern for the perspective on machine 'bodies' taken by engineers; as Pierre Macherey has noted, "To explicate comes from *explicare*: to display and unfold."²⁸⁷ Since explication is intrinsic to both animal dissection and machine maintenance, it is intrinsic to the process by which modern machines were invented, a rendering down of animal specimens to anatomical maps that could be reconstituted as machines redesigned to better serve human purposes. While this rendering process characterized machine development in Victorian Britain, it remains paradigmatic in the twenty-first century. Mechanimal knowledge in the second sense amounts to an explicative perspective *from* the mechanimal body; but also, in the scientific romance—in Verne, in Greer, and, as we shall see in chapter four, in Wells—this is a perspective upon other bodies, which often have political significance. In *Twenty Thousand Leagues*, these bodies were ships, which were both political actors and symbols of their nations of origin, particularly in Britain's case. In the twenty-first century this logic still applies to maritime and

²⁸⁷ Pierre Macherey, *A Theory of Literary Production*, trans. Geoffrey Wall (London, England: Routledge & Kegan Paul, 1978), 83.

aviation vehicles, and to a lesser extent even to automobiles, which sport license plates instead of flying flags. However, in *A Modern Daedalus* the politically significant bodies onto which the mechanimal opens include not only ships but also geographic regions—bodies politic, human-delineated cordons of the Earth’s environs that designate *oikoi*²⁸⁸ of human and nonhuman bodies. This is what I mean when I mention the multivalence of mechanimal knowledge’s body politics. Mechanimal knowledge in the first sense works from one or more specimens, individual bodies that naturally live in or migrate through a specific locale, to construct the mechanimal body; and the mechanimal body’s perspective opens onto these animal bodies and the bodies of the humans that explicate them, but also onto bodies politic. As such, the mechanimal body exists on a middle valence, somewhere between the individual specimen and the aggregated nation.

Critics’ negative reaction to *A Modern Daedalus* suggests that in writing the story Greer committed a political transgression: imagining that Irish bodies could have access to a higher valence in this body politics than they had historically been granted. The same anatomists that explicated animal bodies to gain knowledge of how to construct mechanimals also explicated Irish bodies. The most famous example of this is Charles Byrne, an Irishman who suffered from acromegalic giantism and was famous for his colossal size. Byrne was relentlessly pursued by John Hunter, the famous surgeon and anatomist, who wanted to acquire Byrne’s body upon death in order to study it. By Hunter’s own account, Byrne died in 1783 after a long spell of declining health, “and Hunter, anxious to procure his skeleton, set his man Howison to keep watch on his movements, that he might be sure of securing his body at his death. Byrne learned this, and as he

²⁸⁸ My reasons for choosing this term are not theoretical but etymological: the Greek *oikos* forms the root of “economy” and “ecology,” both of which describe the relationships between the localized bodies circumscribed by the borders of a nation state.

had a horror of being dissected, determined to take such precautions as should ensure his not falling into the hands of the doctors.”²⁸⁹ Hunter’s account goes on to describe his clandestine efforts to acquire Byrne’s body against his stated wishes, an effort that included bribing the men charged with guarding the body until it could be buried, stealing the body and making a circuitous getaway, and hastily dismembering the corpse and rendering it down to the bones so that Byrne’s skeleton could be reassembled and put on display in Hunter’s private collection.²⁹⁰ Not only did Hunter escape prosecution for his crimes, the Royal Society awarded him the prestigious Copley Medal and the American Philosophical Society made him a member for his discoveries. Hunter’s other research normalized animal experimentation, including the types of dissections used in studies of animal locomotion, and was later cited by both Pettigrew and Marey in their research. As a British-educated surgeon, Greer would have been familiar with Hunter’s work, including the fate of Byrne’s remains.

With this in mind, in O’Halloran, Greer imagined an Irishman, a member of a people long treated as specimens, who becomes a scientist with the potential to treat the English themselves as specimens. By imagining a protagonist who could use anatomical knowledge to fly, Greer overtly elevated the Irish over the English. Greer’s description of O’Halloran’s flying-machine as inextricable from his personal history recalled Butler’s morphology of Higgs in *Erewhon*; it also redeployed Butler’s Protheses Theory of machine evolution, but in a way that imagined the Irish might develop wings, though the English could not. After all, O’Halloran’s

²⁸⁹ John Hunter, *The Works of John Hunter, F.R.S., With Notes, Vol. I*, ed. James F. Palmer (London, England: Longman, Rees, Orme, Brown, Green, and Longman, 1835), 106. Here Hunter refers to himself in the third person, observing all the decorum of scientific objectivity.

²⁹⁰ The issue remains unsettled. Amid social, political, and academic pressure, in 2011 the Hunterian Museum decided to keep Byrne’s body on display. The Museum is currently closed for remodeling and will reopen in 2021, and its board of directors has agreed to reconsider the fate of Byrne’s body prior to reopening the collection. Whether they will observe Byrne’s clearly stated wishes to have his body buried at sea remains to be seen.

biomechanical ingenuity predates his British education, for he invents his gull-kite, “the wonder and envy of [his] school-fellows,”²⁹¹ before being educated in the British system of Queens College. His innate attentiveness to scientific details gains him access to British scientific theory and training—in Conrad’s terms, to a higher-resolution map of nature and the tools to explicate the specimens around him. Moreover, his British education affords him the wherewithal to add to Ireland’s and England’s shared cultural map.

O’Halloran’s power to edit this shared cultural map lies in his exclusive access to the secret of aviation. His gull-kite marks the beginning of a career characterized by secretive technological development—“I alone knew the secret,”²⁹² he writes—which is fundamental to his business plan. He flies to London hoping for a handsome return on years of research and development, at least enough money to secure his family’s situation, but also the respect of becoming a scientific and economic contributor to the Empire. However, after causing public panic in London he has to negotiate with Parliament whether he can even sell his wings.

Developing the ability to fly ought to have made him a hero to the Empire, for as he demonstrates to his friends in a trial of his second pair of wings, their speed “will supersede both horse and railway and cost nothing to keep.”²⁹³ He tests this theory *en route* to London when he races the trains below him and discovers that he can “always outstrip their speed with ease.”²⁹⁴ Nevertheless, the way Greer imagines Parliament’s reaction to O’Halloran’s machine in his eighth chapter invokes the same technological conservatism that had led the Admiralty to sideline John Ross a half-century earlier:

²⁹¹ Greer, 2.

²⁹² Greer, 2.

²⁹³ Greer, 67.

²⁹⁴ Greer, 74.

It would be a question with the Government how far it was consistent with the interests of the country—which of course were their supreme guide—to permit the introduction and general use of a means of locomotion which might supersede and render obsolete and valueless communications [i.e., modes of transportation], internal and external, upon which enormous sums of money had been spent, and in which an immense proportion of national and private wealth had been invested. The question of increased facility of intercourse with foreign countries was also one which would demand their earnest consideration, especially in view of questions of national defence and military strategy.²⁹⁵

The “country” and “nation” whose interests and the defense of which are at issue here is not the British Empire, that pillar of freedom in which O’Halloran has long believed, but England, the imperial center, whose leaders clearly intend to maintain its preeminence over the rest of Britain. The Irish MP, in Greer’s story a thinly-veiled Parnell, indicts Parliament’s caution toward “foreign countries,” which he sees as “England’s selfishness and tyranny, and cynical disregard of all interests but her own.”²⁹⁶

After negotiations escalate, O’Halloran is captured and imprisoned in the Clock Tower of St. Stephen’s until he will divulge the secret of aviation. The irony of this situation is that O’Halloran is harboring what amounts to an open secret: he simply worked from the model of the soaring gulls, taking faith in the project thanks to the common sparrow. Since aviation is modeled by species known to both the Irish and the English, flight itself lies within the locus of their shared mental map. By citing birds as evidence that winged, navigable human flight was possible, the argument from sparrows implies that the models for a workable flying-machine are available to anyone who cares to study ornithic flight—including the Irish. Greer recognized that in the pre-aviation world access to the secrets of aviation was democratic; should an Irishman discover those secrets first, he would have a unique opportunity to stage a technological and perhaps also a political revolution. By imagining that an Irishman might develop flight

²⁹⁵ Greer, 108.

²⁹⁶ Greer, 104-105.

before the English did, he provoked his critics' ire by suggesting that aspects of their cultural map—including the importance of common birds and the real state of Irish scientific literacy—might be inaccurate.

The fact that the Home Secretary imprisons O'Halloran in order to gain knowledge of aviation that is essentially free reads as Greer's challenge to Butler's assumption about innate English ingenuity for developing mechanical prostheses. Not only does Greer imagine that an Irishman will discover the secret of flight first, his characterization of the Home Secretary suggests he thought the English were so far behind they could not recognize viable models for a human flying-machine in their quotidian contact with birds. Nor is Greer's Home Secretary a caricature written by a nationalistic Irish detractor, for H. G. Wells would make a similar argument a quarter century later when he reacted to Louis Blériot's historic first aeroplane flight across the English Channel:

Of all that made it possible we can only claim so much as is due to the improvement of the bicycle. Gliding began abroad while our young men of muscle and courage were braving the dangers of the cricket ball. The motor-car and its engine was being worked out "over there," while in this country the mechanically propelled vehicle, lest it should frighten the carriage horses of the gentry, was going meticulously at four miles an hour behind a man with a red flag. Over there, where the prosperous classes have some regard for education and some freedom of imaginative play, where people discuss all sorts of things fearlessly and have a respect for science, this has been achieved... In the men of means and leisure in this island there was neither enterprise enough, imagination enough, knowledge nor skill enough to lead in this matter... Either we are a people essentially and incurably inferior or there is something benumbing in our atmosphere and circumstances.²⁹⁷

While the educated were relaxing, Wells charged, England—he specifically criticized "the English"—was falling behind France in aviation. Greer's Home Secretary fits Wells's

²⁹⁷ H. G. Wells, "Of a Cross-Channel Passage," *The Daily Mail* 4148 (27 July 1909): n.p.

description of the educated leadership of Victorian Britain, suggesting there is more to it than Greer's politics.

O'Halloran's imprisonment incites him against the English once and for all. After his brother Dick helps him escape, the secret to his wings begins to leak. First, he teaches Dick to fly and they return to Ireland. Owing to a rash of assassinations of British landlords perpetrated by a growing Irish resistance using guerilla tactics, open war is immanent. The English invade the Irish North and occupy Belfast. Upon returning to Dublin, O'Halloran recognizes that the first thing to be done is "to produce as many machines as possible; the second, to train a body of men in their use,"²⁹⁸ his new mission. "I then devoted myself to teaching the use of the wings, in which I was ably assisted by Dick," he recounts. "It never occurred to me that by doing so I was giving up for nothing the exclusive possession of the secret for which, but a few days before, I had refused a million [pounds sterling]."²⁹⁹

With access to knowledge of the world from the point of view afforded by his mechanical prostheses O'Halloran can extensively affect Ireland's and England's shared cultural map. Even apart from their potential use as a weapon, his wings threaten to give the Irish a God's-eye or bird's-eye view on England, and by the late nineteenth century this view was essential to an emerging vision of future political control. Adnan Morshed has associated the view from above with what he calls "the aesthetics of ascension," a discourse marked by "a peculiar blend of godlike spectatorship, technological utopianism, and evolutionary idealism—all converging to create the seductive myth of a master builder, able to redeem a chaotic world

²⁹⁸ Greer, 193.

²⁹⁹ Greer, 197.

from his high perch of authority.”³⁰⁰ This view was associated with, among others, the thinking of Friedrich Nietzsche, and made sense in the context of the hierarchical logic of Victorian social class. The revolution O’Halloran ushers in—the revolution Greer imagined—is essentially scientific and technological, but with far-reaching political implications.

While for much of the world the view from above was a vision for the modern future, the Irish had already been subjected to it in the form of the Ordnance Survey, as I mentioned above. Cólín Parsons has noted that the Ordnance Survey’s “work indexes most clearly one of the great changes of the nineteenth century that we can see as a signal event in the emergence of modernity—what Raymond Williams calls simply, ‘the loss of a credible common world,’”³⁰¹ brought about by the redefinition of Irish places and the Anglicization of Irish names. In recent scholarship, this modern fragmentation has opened a panoply of perspectives on Ireland and the documents that constructed it as a material and cultural entity. For example, Stiofán Ó Cadhla has argued that

When you look at the survey, instead of through it, there is more to be learned about the surveyor than the surveyed, more about the mammoth metropolis of London than the humble hovels of Galbally. The presence of the ostensible subject of the survey, Ireland or the Irish, is shadowy at best. It is undeniable that it was an engagement with vernacular culture but, and this is the important point, it was a particular kind of engagement that was articulated in a particular dialect of an imperious and almost impervious evolutionary science.³⁰²

Parsons, however, pointed out that Survey employees, many of whom were Irish, recognized in the work to map locales an opportunity to define Ireland as a nation and a people by identifying

³⁰⁰ Adnan Morshed, *Impossible Heights: Skyscrapers, Flight, and the Master Builder* (Minneapolis, MN: University of Minnesota Press, 2015), 7.

³⁰¹ Cólín Parsons, *The Ordnance Survey and Modern Irish Literature* (Oxford, England: Oxford University Press, 2016), 3. Here Parsons cites Raymond Williams, *The Country and the City* (Oxford, England: Oxford University Press, 1973), 253.

³⁰² Stiofán Ó Cadhla, *Civilizing Ireland: Ordnance Survey 1824-1842: Ethnography, Cartography, Translation* (Dublin, Ireland: Irish Academic Press, 2007), 5.

and articulating the essence of the land and its inhabitants. He sees this dynamic as integral to a series of contradictions that make the Ordnance Survey the cultural origin of Irish modernism: “competing temporalities of new and old,” “scales of locality and nationality,” and a “drive to destroy and to restore.”³⁰³

By writing an Irish inventor with a navigable flying-machine—and its navigability is important because without it a pilot could not choose what to look at; this was the problem with balloon photography—Greer implied that the Irish could attain the access needed to write or rewrite the cultural map they shared with the English. The Ordnance Survey underscores Victorian England’s interest in a shared cultural map, both literally and figuratively, but the English assumed they would be doing the mapping and the Irish would merely accept and use whatever map they made. By contrast, the logic of the future that Greer imagined in *A Modern Daedalus* more or less argues that if an Irishman were to invent a flying-machine and, out of good-will, try to sell it in London, English cultural hegemony would take priority over the Empire’s best interests: English classism and jingoism would force the Irish to make a bid for national independence. At an even more basic level, this sets up a disjunction between English cultural hegemony and an Anglo-Irish scientific partnership essential to the flourishing of the British Empire. Barring any hope of such a partnership, Greer assumed an Ireland in possession of the secret of aviation would seek independence. From our own historical moment, the snide responses from many of Greer’s critics are characteristic of the English outlook that eventually incited the Irish Easter Rising.

Explication and the Mechanimal Terror

³⁰³ Parsons, 3-4.

Sloterdijk's notion of "explication" not only clarifies the body politics of mechanimal knowledge, it also reveals the politics of Greer's act of imagining a mechanimal. Here the *Dublin Review* column, which expressed reservations about the judiciousness of imagining flying Irish commandos, is germane. As Conrad has pointed out, in the context of Anglo-Irish tensions during the 1880s, literature and dynamite functioned as alternate forms of political expression; the same could be said of the relationship between literature and mechanimal knowledge. Simply put, Greer's act of imagining that an Irishman had the knowledge of aviation and, therefore, access to the view from above, prompted an English reaction similar to what actually having such access would have prompted. His critics' snide response could only be snide because no Irishman at the time *did* have access to these kinds of knowledge; if they had, critical sarcasm would have given way entirely to the fear that also appears in the original reviews of *A Modern Daedalus*. The alarm some critics expressed underscores the extent to which even fiction explicates. To paraphrase Sloterdijk, by imagining a flying-machine that integrated function with perception, and by imagining that O'Halloran's perception of the environment from within the machine could clarify the conditions of English troops' life amid guerrilla combat, Greer demonstrated that the Irish were smart enough to know how to use aviation should they discover its secrets first. By making this so plain, he demonstrated that mechanimals were as much terrors as wonders; and this makes sense because, by explicating, knowledge of the world from within a mechanimal prosthesis or vehicle conflates scientific and military applications.

Sloterdijk locates the emergence of explication the early twentieth century, which "will be remembered as the age whose essential thought consisted in targeting no longer the body, but

the enemy's environment."³⁰⁴ For him, the signature example of this is Germany's development of chemical weapons amid the trench warfare of the Great War. "By working on the enemy's environment," he argues, modern combat, "which consist[s] in suppressing the basic prerequisites for life, yield[s] the contours of a specifically modern... concept of terror," which he sees as predicated on and, implicitly, the logical consequence of explication.³⁰⁵ Sloterdijk views terror as operating "on a level beyond the naïve exchange of armed blows between regular troops; it involves replacing these classical forms of battle with assaults on the environmental conditions of the enemy's life. What dictates this shift" in the early twentieth century "is the emergence of encounters between opponents vastly unequal in strength."³⁰⁶ Even though it is fiction, *A Modern Daedalus* is a case study in explication-informed terrorism, as Sloterdijk has theorized it, for in the story Greer imagines three aerial attacks on British forces that demonstrate the incendiary terrorist power of aviation and the view from above it affords.

In the first attack, O'Halloran and his freshly trained forces bomb Dublin Castle, which at that point in the story is the last British stronghold in the South of Ireland. They attack under the cover of darkness, spotlighting the castle in the beam of a high-powered electric lamp, a prototype of the modern searchlight. Their view from above the illuminated castle reveals the positions of its interior buildings and the troops garrisoned in the yard. The walls of the castle become the garrison's demise when O'Halloran's men drop their bombs.

Several fell upon the roofs, through which they crashed, and one or two walls were heard to thunder down. When the infernal rain was over... Broken roofs and shattered walls stood up in ghastly nakedness under the glare of the electric light; below, heaps of bricks and mortar, plaster and broken glass, and bodies of men in uniform half buried among the

³⁰⁴ Sloterdijk, 14.

³⁰⁵ Sloterdijk, 15.

³⁰⁶ Sloterdijk, 16.

ruins. A few forms were seen moving about in the open spaces, and shrieks and groans came up to our ears.³⁰⁷

Hours after the attack, Dick, who has helped to dig the wounded out of the castle ruins, tells O'Halloran that "One fellow was dug out with almost his whole face blown away—hardly the semblance of a feature left—and yet he was alive."³⁰⁸

Given the recurring theme of the cartographic aesthetic of the view from above, it bears mentioning that among the detailed diagrams from the Ordnance Survey reprinted in J. H. Andrews's history, *A Paper Landscape* (1975), is a plate from the 1840 five-foot town plan of Dublin that features Dublin Castle—not only the building on a map, but a detailed architectural drawing including rooms, green spaces, entrances, and windows as well.³⁰⁹ When O'Halloran returns from bombing the castle he receives a summons to the General's quarters; he finds him "with a chart in his hand," suggesting that the nearby Ordnance Survey office has been raided as the castle was besieged. The terror that O'Halloran and his commandos rain on the garrison is made possible by the explicative view from above and the cartographic data collected by the Ordnance Survey years before.

For Greer's English readers, such references to cartography would have raised troubling questions about the revolutionary applications of Ireland's cartographic acumen, especially since the Irish had made better progress in mapping Ireland than either the Scots had made in mapping Scotland or the English in mapping England and Wales. Richards has noted that in the decade or so prior to *A Modern Daedalus*, until about 1940, "the task of collecting and classifying

³⁰⁷ Greer, 202.

³⁰⁸ Greer, 214.

³⁰⁹ J. H. Andrews, *A Paper Landscape* (Oxford, England: The Clarendon Press, 1975). See Plate IX between pages 128 and 129.

knowledge increasingly fell to civil servants”—such as the Irish—“operating under state [i.e. British] supervision.”³¹⁰ States that nationalized in the wake of such supervision, Stiofán Ó Cadhla has pointed out, “could be viewed as inheriting the intellectual apparatus of Empire. In striving for uncertain legitimacy official state nationalist discourse often reiterated colonialist discourse.”³¹¹ It therefore comes as no surprise that where the Irish were once guerrilla warriors now they have a general, where they used to be equipped only with American-made rifles they have since developed wings and bombs and searchlights. By this point in the story, the once-disorganized resistance has become a rising power, thanks largely to British science’s explication of Ireland’s body politic.

Shortly after bombing the castle, O’Halloran’s brigade stages a second attack on three British ironclads in Dublin Bay, focusing on destroying the ships rather than the sailors’ bodies. Targeting the first ship’s funnel, the smokestack leading to the boiler powering the engine in the hold, they drop bombs in hopes of causing a boiler explosion that will disable the ship and devastate its crew, if it does not sink the ship altogether. They miss the funnel but provoke a furor of rockets and incendiaries that light up the flotilla against the blackness of Dublin Bay, making it eerily visible from above. While the first ship founders on, fighting a fire below deck, the flying Irish move to the second, which has begun firing rockets as well. With its crew focused on the water, O’Halloran himself stealthily hits the funnel this time, and the ship’s lights suddenly go dark amid the eerie sucking sound of its sinking. The third ship, sensing danger, promptly extinguishes its lights and slips away.

³¹⁰ Richards, 11.

³¹¹ Stiofán Ó Cadhla, *Civilizing Ireland; Ordnance Survey 1824-1842: Ethnography, Cartography, Translation* (Dublin, Ireland: Irish Academic Press, 2007), 89.

In this second attack Greer demonstrates the power of the cartographic view to explicate the basic unit of naval power: the ship. When the general orders this attack he shows O'Halloran the ships' approximate positions on a map, which functions as a basic model of his and his commandos' aerial view. But cartography's ability to locate ships was only the beginning: the ironclads' greatest weakness, their funnels, were only visible from above. Since the likelihood of dropping a small explosive into an ironclad's funnel without a navigable flying-machine was nil, the way Greer imagined O'Halloran's destruction of the ironclads underscored the importance of aviation for identifying the enemy presence on the battlefield and for eradicating enemy soldiers by precisely targeting the structures designed to keep them alive—i.e., by explicating the conditions of their survival.

A third attack explicates the encampment of a British expeditionary force sent to quell the Irish rising. The Irish rising, now a fully supplied army, travels north to meet the British *en route* from Dublin and destroys a field encampment the British have made along the main rail line between the cities. As in the previous attacks, O'Halloran and his commandos are instrumental to attaining victory. From overhead they glimpse the enemy navvies' lanterns as they build earthworks in the dark, preparing for a pitched battle the next morning. O'Halloran's men rain petrol on the British tents and trucks and land behind enemy lines to mine the rails near the camp with dynamite. When the rail line is destroyed, the fire ignites the entire camp, exploding the munitions stored there. The death that follows is hellacious. "I still seem to see hurrying crowds of figures," O'Halloran writes in traumatized retrospect, "some shining like red-hot metal under the fierce glare, others black like stage devils against a background of raging flame, which leapt out and vanished into the surrounding darkness."³¹²

³¹² Greer, 238.

Not only are enemy bodies destroyed by being engulfed in this imbroglio, the camp itself is literally wiped off the map: “For a minute it lasted, and no longer; the fierce blaze went out as suddenly as it had arisen; the infernal roar died into a blank silence; and of the lurid vision that in a few seconds had burnt itself indelibly into my brain, nothing remained except a few smouldering sparks upon the ground, and a dense black cloud that blotted the stars from the sky.”³¹³ Blank silence; nothingness; a blackness that blots out even the stars. O’Halloran is horrified by having to reimagine it, and by the realization that his actions have wrought the destruction that horrifies him even in recalling it. This horror and its correlates—fear and terror—call to question the romance’s imperial values of glory won for the homeland, and, by extension, the aura of wonder with which the tools of such conquest are so often imbued.

Mechanical Knowledge: Terror Concealed

Conrad has already noted the extent to which the critical reaction to *A Modern Daedalus* was motivated by terror at the prospect of a Fenian dynamite attack. I would add that such terror is compounded by the mechanical’s tendency to stymy knowledge that a given body is a mechanical, the knowledge that what appears to be an animal is really a human-made machine. Although mechanical knowledge in this sense does not explicitly appear in *A Modern Daedalus*, the premises of it do. These include a combatant’s tendency toward secrecy or concealment, and situations in which a mechanical body helps a human appear as something other than a human; both are integral to the story’s political subtext.

I have already discussed O’Halloran’s secretive tendencies above, but they should be understood within a broader range of Irish secrecies depicted in *A Modern Daedalus*. For

³¹³ Greer, 238.

example, when O'Halloran witnesses the assassination of the landlord, the assassins are camouflaged: "concealed by a few bushes of gorse from the observation of their victims, but plainly visible from above, two men lay on their backs, the barrels of their Metford rifles resting across their toes."³¹⁴ During the early days of the rising a combined force of soldiers and policemen sent to enforce an eviction are encircled by similarly concealed resistance fighters: "from every hedge and wall around were seen the levelled tubes of loaded rifles."³¹⁵ Aside from any symbolism, the characteristically Irish "wearin' o' the green" camouflages Ireland's men among the green countryside.

But these episodes also reveal a characteristically Irish shrewdness in forming a fighting body that does not look like one, a subversion of the rules of engagement which O'Halloran views as "a species of cant born of the idea that war is a magnificent game for kings and nobles, and must be carried on under rules that disguise its essentially revolting nature, and prevent it from being too dangerous or disagreeable to them."³¹⁶ Such subversion of the rules of engagement means that a fighting body that does not look like a fighting body could look like anything else. Greer applies the same logic to the individual fighter when he imagines O'Halloran's body as other than human, at once both supernatural and animal. After O'Halloran successfully attacks the British ironclads, he returns to Dick's exclamation: "'God bless me, Jack, you look like a ghost!'"³¹⁷ His and his flying commandos' is a "ghastly work,"³¹⁸ a

³¹⁴ Greer, 22.

³¹⁵ Greer, 140.

³¹⁶ Greer, 247.

³¹⁷ Greer, 212.

³¹⁸ Greer, 205.

“devilish business.”³¹⁹ He and Dick imagine that they ““must look more like a flight of wild geese than anything else, from below,””³²⁰ but O’Halloran also realizes later “how like huge bats were the figures that flitted around me in the gloom,” i.e. his men, and that “the wings they used were of the form attributed by superstition to devils, rather than to angels.”³²¹

Here critical comparisons with Verne again make sense. To return to Bradbury’s characterization of the *Nautilus* as a mechanical whale, the drama of *Twenty Thousand Leagues* issues from the *Nautilus*’s layers of interpretability. As Aronnax and his friends discover, one may understand even the mechanical’s machinations without recognizing its inventor’s purpose, and since a mechanical’s purpose is always a human purpose—in *Twenty Thousand Leagues* it is Nemo’s purpose—the mechanical’s presence is always potentially a political issue, if for no other reason than that it affects the material environment that humans share. Moreover, the mechanical body’s tendency to occlude not only its own machinations, not only the human purposes those machinations serve, but the very fact that the mechanical is a machine and not an animal, turns out to be another of its functions. This is no less true of O’Halloran’s goose- or bat-like flying-machine in *A Modern Daedalus*. When the mechanical is considered as a nineteenth-century technological phenomenon, it makes little difference *which* species a mechanical mimics because the ultimate purpose of such biomimicry is to add another layer of occlusion: what was already an intricate machine with an indecipherable *telos* is further disguised as a nonhuman.

³¹⁹ Greer, 218.

³²⁰ Greer, 227.

³²¹ Greer, 238-239.

Such misdirection from the mechanical's true ontology also conceals the fact that its presence is a human act. When a (human-made) machine is designed to appear wholly biological, like a goose or a bat, then one purpose of its design is to attempt to pass as something that is not human-made. To the extent that a mechanical appears to be an animal, it invites the assumption that its presence is coincidental; and this circumvents any questions about the humans that made the machine—about their purposes, politics, etc. On this matter, Greer's first critics' original instinct to compare *A Modern Daedalus* and *Twenty Thousand Leagues* turns out to have been quite helpful. A comparative reading suggest that Greer was hardly dazzled by the mechanical wonder; instead, he recognized the mechanical was just as likely a terror. When Verne wrote *Twenty Thousand Leagues* his editor, Hetzel, forbade him from identifying Nemo's nationality or race in order to avoid political controversy and government censorship. Thanks to Hetzel's censorship, *Twenty Thousand Leagues* left unexamined the most important political aspect of mechanical knowledge: *which* human's or humans' purposes does the mechanical body occlude?

Verne's and Greer's respective approaches to this question variously emphasized the importance of the machine's workings and the identity of the person who built and deployed it. By giving his reader knowledge that the *Nautilus* was in fact a mechanical, Verne generated awe at the machine itself³²² and distracted the reader from the culturally- and nationally-unidentifiable Nemo. By contrast, Greer offered few technical details about O'Halloran's flying-machine, but overtly identified O'Halloran as Irish. This inversion stymied his reader's wonder at the machine and instead raised concerns about the inventor/pilot's character, which the non-

³²² As Isaac Asimov once described Verne's stories, his "concern with utter scientific justification loaded his stories with explanation and made them, all too often, little more than devices for describing gadgetry." See Isaac Asimov, "The Contribution of H. G. Wells," in H. G. Wells, *The Time Machine and The War of the Worlds*, intro. by Isaac Asimov (New York, NY: Ballantine Books, 1983), 16.

Irish Anglophone world viewed with suspicion. Once suspicious of O'Halloran, Greer's readers feared his flying-machine. Simply put, if one does not know what a machine does, and one does not trust its inventor, that distrust transfers to the machine itself. The mechanimal body's tendency occlusion of what it really is and does, once discovered, only enhances the distrust. In Greer's case, the distrust of the inventor led to distrust of the machine itself: whereas Verne's unidentifiable inventors conjure mechanimal wonders, Greer's overtly Irish inventor could not, as a result, conjure anything but a mechanimal terror.

Regardless of the fact that Greer never invented such a machine, he deserves credit for advancing the scientific romance by rethinking the wonder as a terror. Sloterdijk points out that "New weapons of terror are those through which the basic means of survival are made more explicit; new categories of attack are those which expose—in the mode of a bad surprise—new surfaces of vulnerability," such as the hulls of modern ships in *Twenty Thousand Leagues*. Sloterdijk defines a terrorist as "anyone who gains an explicative advantage over the implicit conditions of the enemy's life and exploits it for the act."³²³ Whereas Verne imagined a Captain Nemo whose entire purpose in developing the *Nautilus* was to use it to exploit the condition of his enemies' lives, i.e. the integrity of their ships' hulls, Greer was able to distinguish between the development of an explicative advantage and exploitation of it. When O'Halloran develops the ability to fly, he is primarily interested in flight as the solution to a mathematical or physics problem, and as the fulfillment of the aeons-old human desire to fly. Even after so much incendiary conflict, *A Modern Daedalus* ends with hope that "one day" O'Halloran might "go

³²³ Sloterdijk, 28-29.

forth free and unknown, to realize [his] old dream” of an international brotherhood with all humankind brought about through flight.³²⁴

Any vision for exploiting his flying-machine is born out of the conflict erupting from Britain’s mistreatment of the Irish, or, more generally, out of British imperialism. In the context of the Anglo-Irish conflict, Victorian English literary critics who still naïvely believed in the impregnability of England owing to its island geography saw a flying-machine in any hands but English hands as a terrifying vision of the technological future. As Wells’s editorial demonstrates, for the English, there was no comfort in an aviating world wherein enemies might land in London at any time—or shower it with petrol and firebombs. Moreover, to the extent that such an invader might appear to be a goose, or a bat, or some other creature not only amplified the fear, it undermined the British imperial administrative reflex to target the problem and enforce whatever measures were in the best interest of the Empire. As the first author to imagine that a biomimetic machine might not be all that wondrous, Greer also recognized that not even the first inventor to develop such a machine would be likely to benefit from it, since the Empire had the wherewithal to confiscate his work without compensating him, and to use it without regard for his original intentions.

The problem with recognizing Greer for imagining a terrifying mechanimal prosthesis, even if only in a literary sense, is that it reconstitutes him as the stereotypical Irish terrorist. Since a mechanimal is a terror, Greer’s critics’ reactions at their most fearful suggest *A Modern Daedalus* is a blueprint for an Irish rising, making Greer himself a terrorist and therefore evil, whether madman or genius. Take note: there is nothing to suggest that Greer ever engaged in acts of terrorism, or even violence. For this reason, the merit of Sloterdijk’s definition of

³²⁴ Greer, 261.

terrorism is that it invites a reexamination of the violence Greer imagined—the attacks on Dublin Castle, the Royal Navy’s ironclads, and the British expeditionary force, attacks that could be construed as “acts of terror,” in current usage—within the larger context of, as many Irish experienced it, British imperial culture characterized by terror intensified by incipient modernity.

Sloterdijk defines terrorism as “a form of exploration of the environment from the perspective of its destructibility” that “exploits the fact that ordinary inhabitants have a user relationship to their environment, that they instinctively and exclusively consume it as a silent condition of their existence.”³²⁵ Understood this way, how could the Ordnance Survey, carried out by British agents walking around Ireland mapping plot lines and recording names, *not* draw Irish suspicion? Even though the Survey employed Irishmen, it was a boon to wealthy English investors, offering information on who owned what and lived where, no doubt a useful tool in making profitable landgrabs and, later, for evicting the Irish rural poor. Moreover, the crowbar brigades sent by English landlords to carry out such evictions, such as those depicted in *A Modern Daedalus*, were paradigm cases of terrorism according to Sloterdijk’s definition, for they evicted by mitigating the conditions that made a homestead habitable. Their actions “presuppose an explicit concept of the environment,” which is essential to a terror that “involves the displacement of destructive action from the [enemy’s body] onto his ‘environment’ ... the milieu in which enemy bodies move.”³²⁶ In *A Modern Daedalus* the crowbar brigades’ behavior epitomize the extent to which “Terrorism, from an environmental perspective, voids the distinction between violence against people and violence against things: it comprises a form of

³²⁵ Sloterdijk, 28.

³²⁶ Sloterdijk, 22.

violence against the very human-ambient ‘things’ without which people cannot remain people,”³²⁷ including homestead roofs.

Notably, O’Halloran’s violence later on is also directed at such human-ambient things: castle walls, ironclad funnels, and tents. Clearly, Sloterdijk would not deny that O’Halloran’s actions constitute terrorism in the sense of “a *modus operandi*, a fighting method that immediately spreads to both sides of the conflict,”³²⁸ characterized by a “willingness and readiness of partners in conflict to operate in an expanded zone of warfare.”³²⁹ However, compared to evicting people by destroying their homes, Irish disregard for traditional military rules of engagement in a bid to secure their homeland seems less morally questionable—particularly according to a nineteenth-century British imperial cartographic logic that located races within specific, cohesive, identifiable geographic regions. As a bid to keep the English in England, Irish efforts to expel the British troops sent by England to subdue Ireland is a logical extension of the imperial cartographic view.

Although O’Halloran and his commandos expand the battlefield spatially, into the air, they do not expand the battlefield politically: the castle, the ironclads, and the encampment are all military targets; by contrast, Northern Irish homesteads are civilian zones. Whereas Greer depicted British troops as willing to expand the zone of Anglo-Irish conflict politically, he portrays the Irish as willing to expand the zone of conflict only environmentally. In the book’s introduction, O’Halloran dissociates himself from the Fenian dynamiters who attacked London in the early 1880s. Nevertheless, when the British invade Ireland, he is ready to deploy dynamite

³²⁷ Sloterdijk, 25.

³²⁸ Sloterdijk, 26-27.

³²⁹ Sloterdijk, 27.

in defense; effectively, Greer has imagined an alternate history featuring England as the aggressor and the Irish as mere defenders. But to his critics, especially those writing from England, the Fenian attacks of the early 1880s were unforgettable. The discourse between Greer and his critics performs the dynamic of terrorism as a *modus operandi*, wherein “every terrorist attack sees itself as a counterattack in a series allegedly always started by the enemy. As a result, terrorism conceives itself in an ‘anti-terrorist’ fashion.”³³⁰

I mention this dynamic here in order to elide any attempt to determine who—England or Ireland—is ultimately to blame, to note the terrorism endemic to the imperial *milieu* of late-nineteenth-century Anglo-Irish relations, and to point out that the mechanimal terror emerged from this cauldron of terrorist explication—*regardless of who started it*. The tendency to escalate the conflict using scientific knowledge, e.g. anatomy and cartography, and technological development, e.g. dynamite, rifles, search lights, and manufacturing, exacerbated belligerent adversaries’ pursuit of future machines in order to attain military supremacy. As such, the vision of a weaponized mechanimal is a product of a culture of imperialism.

The belligerence of modern nations outran their scientific and technological capabilities, however. The human-piloted war machines that characterized the World Wars were only prototypes, early attempts at the biomorphic machines imagined in the scientific romances. In the seventy-five years since World War II, these designs have been refined, notably in the United States, in order to remove their human pilots and increase their destructiveness and stealth. In the next chapter I turn to the work of H.G. Wells, by whose influence and popularity the mechanimal vision traveled to America, where it is now being realized.

³³⁰ Sloterdijk, 26-27.

Chapter IV: Mechanimal Vehicles and H. G. Wells's Future World State

The horse was the only means of transport for thousands of years. The steam engine has outlived itself during the last hundred years and will soon be just as much an anachronism as the hansom cab. Thus Wells enters the world of Jules Verne... In order to be at home in it all he needed was to use the methods of the travel and adventure novel. So we see him beginning to develop this Jules Verne theme with *The War in the Air*.

-J. Kagarlitski, *The Life and Thought of H. G. Wells*

By the time H. G. Wells began writing scientific romances, Jules Verne's *Twenty Thousand Leagues* had been translated into English and published in both England and the United States, and, as noted in Chapter II, Verne's *The Clipper of the Clouds* had influenced Octave Chanute's thinking about aviation. Nor did Wells directly address an American readership until after the Wright Brothers had flown at Kittyhawk. It is therefore difficult to argue that Wells was the first to transmit the mechanimal vision to the U.S. However, it is difficult to identify anyone else who so thoroughly linked European writers' visions of mechanimals to a future vision of a flourishing modern American democracy with global influence. The American ascent to international prominence that Wells advocated assumed the development, mass production, and deployment of mechanimals. Whereas Verne cast the mechanimal vision for some distant future and raised the issue of what country the inventors of futuristic machines would come from. In response, Wells decided that the United States would realize the mechanimal vision and exercised both literary and political influence in attempting to convince Americans to do so.

Few scholars have considered the extent of Wells's political influence because, in addition to shaping the modern world during the first half of the twentieth century, that very influence also shaped Wells scholarship. On the one hand, twentieth-century literary inquiry was heavily influenced by those we now know as the modernists, many of whom viewed Wells and

his views antagonistically. For this reason, Wells scholarship has long been relegated to a marginalized science fiction studies, which has not been consistently represented in English departments and disciplinary critical discourses. On the other hand, Wells scholarship has historically reacted against this marginalization by treating Wells as a champion of science fiction, lionizing him and his work in attempts to defend science fiction against its detractors and also, sometimes, to garner legitimacy by emphasizing the genre's prescience (particularly its technological prescience), popularity, and profitability. Where these criteria apply, Wells has been celebrated for his literary production and his work has been lauded as science fiction at its most 'prophetic' (Wells's term). As such, Wells's writing and science fiction studies have long been mutually constitutive discourses that ratify one another's value within, and often against, the larger disciplinary context of English literature.

That Wells scholars have continued to laud his prescience is particularly puzzling, given science fiction's commitment to a scientific paradigm with which prophecy, historically a mystical or religious concept, has long been at variance. I tend to read such uses of the terms "prophet" and "prophetic" as naturalist or antitheist appropriations, reactive attempts to dismiss supernaturalism or theism; but there is an argument to be made that applying "prophecy" language to Wells in particular and science fiction generally has only fanaticized science fiction's followers. Even bracketing the incongruence between religious rhetoric and scientific allegiance, critical celebration of Wells's prophetic foresight implies either naïve fanhood or a willful ignorance of evidence that better explains the 'prophecies' that have contributed to Wells's reputation: his far-reaching political connections, through which he propounded and broadcast his visions for a World State aimed at ensuring world peace, and a future marked by modern vehicles that could facilitate world governance. For one of the so-called "fathers of

science fiction” to have leveraged such political connections in shaping the modern world only feeds a critique against which science fiction scholars have long felt a need to defend, i.e. the view that science fiction is inherently imperialistic. It seems, therefore, that if Wells’s legitimacy is to be given full critical consideration, an unavoidable result is that Wells’s political connections must come under scrutiny and may yield an account that one of the most celebrated writers of science fiction was engaged for years in a project of international influence through propagandist literature.

The years 1893 to 1912 mark a stretch of Wells’s career in which he was intensely interested in what might be called “bodily possibilities,” the shapes of things to come, to borrow his own phrase, but described in corporeal terms. Wells’s studies in biology explain his corporeal descriptions of both vehicles and nations, descriptions that invoked the metaphoricity of anatomy and mechanicity to conjure wonder at the technological future, to reflect (English) terror at the possibility of being out-evolved by political rivals or racial others, and to barbarize the international rivals of Anglophone nations. Whereas Wells increasingly saw England as technologically lagging, in the United States (“America”) he saw a future-oriented culture that could be made an ally, thanks to common language and culture. His appeals to an American readership were calculated to incite American allegiance to Britain, granting the British Empire the support of an industrialized, scientifically advanced ally, particularly as a modernizing, industrializing Germany became more militant. But beyond political alliances, Wells saw the United States as the world’s best hope for leadership in founding a World State favorable to England; and his 1908 story, *The War in the Air*, was central to his effort to articulate the need for a World State inaugurated by American-made mechanimals.

My work here, then, is to exposit Wells's advocacy for the development of American mechanimals, which were integral to his vision of a World State. First, I recount Wells's corporeal thinking in the years leading up to the Great War, which evolved into the technological vision of *The War in the Air*. Second, since it has received less attention than Wells's other works, I summarize *The War in the Air*, emphasizing the centrality of his animal-like vehicles. Third, I note the extent to which the narrative of Wells the prophet has generally shaped Wells scholarship. Fourth, I trouble this narrative by expositing Wells's political networking, which I see as a likelier explanation for the 'coming-true' of his 'prophecies': Wells did not foretell the future, he constructed it with his prolific writing and political engagement. Wells's political engagement reveals (1) a specific focus on American readers dating back to at least 1906; (2) his deliberate efforts at cultural influence, which were often more about Wells's vision of himself than about what was best for the world—one attempt at influence contributed to the Cold War, after all; and (3) the ways he propagandistically stoked xenophobic fear by animalizing the international other and their machines. By offering an account of Wells's future vision in terms of his cultural and political influence I demonstrate that he sought to awe and terrorize American readers into adopting a material and structural social vision that promised world peace but ultimately established the preconditions of the wars that wracked the world during the twentieth century.

Wells's Mechanimals: Bodily Possibilities

Wells's mechanimals in *The War in the Air* are best understood as an extension of his scientific thinking in the late nineteenth century. In his studies in the natural sciences Wells became interested in biology thanks largely to T.H. Huxley, one of his instructors, who fired his imagination. Huxley, nicknamed "Darwin's bulldog," spent his career defending the softer-

spoken Darwin's theory of evolution in various fora, including widely attended public lectures featuring live dissections and vivisections demonstrating the structures and functions of animal bodies. In 1893 Wells published his first book, a two-volume *Textbook of Biology* featuring diagrams of dissected animal bodies and instructions for performing one's own dissections at home. Because of its medical value, Wells remained ardently pro-vivisection until at least the 1920s.³³¹

But for Wells, dissection was merely a means to what he appreciated most about science: its theoretical possibilities, the as-yet-unattained developments that, on paper at least, were just a matter of time and effort. Nowhere was this more apparent than in *The Island of Doctor Moreau: A Possibility* (1896), wherein Moreau, Wells's resuscitation of Mary Shelley's Dr. Frankenstein, removed and recombined animal parts in an ultimately futile attempt to create human life. The story exudes Huxley's influence on Wells, for Moreau and Prendick, his antagonist and protagonist, respectively, have both studied under Huxley. Throughout his life Wells held the anatomist's tools in high regard, despite his vociferous critiques of the death and destruction caused by world war. Although Wells objected to *human* death, he saw the rest of nature as raw material available for human use in the pursuit of scientific, technological, social, and political progress. *Moreau* indicates that Wells knew quite well how slow and fragile evolutionary progress is.

In fact, the stories Wells wrote during the years leading up to the Great War exude considerable fear that humans would be out-evolved. In *Moreau* the ostensible adversary of humankind is Kingdom Animalia, for Moreau's life's work is to make animals human; but he is

³³¹ H. G. Wells, "For Vivisection," in H. G. Wells and George Bernard Shaw, *Experiments on Animals: Views For & Against* (London, England: British Union for Abolition of Vivisection, 1927), 2-11.

killed by his creations, which then degenerate. *The War of the Worlds* (1898) inverted the logic of *Moreau*, for in it Wells imagined humankind's sudden discovery of a more-evolved, more-technologically-advanced, predatory Martian species that destroys humans as though they are a pestilence. As Sarah Cole has recently noted, "Over and over we are told that the Martians' handling of their human victims is exactly as callous as how people behave toward wasps, ants, cattle, sheep, and so on."³³² Read this way, *The War of the Worlds* was occasioned by Wells's recognition that humans—in a notable echo of Butler, these are specifically English humans—increasingly threatened to out-evolve a cosmic neighbor of which they had previously been ignorant. A broader view of this stage of Wells's writing, which roughly spanned the 1890s, shows that his concerns about the implications of progressive evolution issued in one of the major tensions in his *oeuvre*: which species or race will rise to preeminence? Wells viewed this situation through a logic that held that England must "out-evolve or be out-evolved," to adapt the old adage; this logic applied to both his fiction and nonfiction throughout his career, and often informed his appeals to his readers.

As the twentieth century dawned, Wells addressed his fear that England might be out-evolved by attempting to envision the future based on the recent past and the scientific, technological, political, and social *status quo*, which he did by "anticipating," as he called it. He believed that "an inductive knowledge of a great number of things in the future [was] becoming a human possibility,"³³³ one by which other possibilities could be accurately induced. His signature effort to anticipate was *Anticipations of the Reaction of Mechanical and Scientific Progress Upon Human Life and Thought* (1902), which he later explained as characteristic of "a

³³² Sarah Cole, *Inventing Tomorrow: H. G. Wells and the Twentieth Century* (New York, NY: Columbia University Press, 2019), 309.

³³³ Wells, *Discovery of the Future*, 33.

more modern and much less abundant type of mind” that “thinks constantly and by preference of things to come, and of present things mainly in relation to the results that must arise from them.”³³⁴ Wells saw this type of mind as “constructive in habit,” a “legislative, creative, organizing, or masterful type, because it is perpetually attacking and altering the established order of things, perpetually falling away from respect for what the past has given us. It sees the world as one great workshop, and the present is no more than material for the future, for the thing that is yet destined to be.”³³⁵ In an effort to attain a better view of the future, he went to work imagining what was technologically possible based on then-current machines.

By the time Wells published *Anticipations*, he was much more interested in imagining the “mechanical possibilities”³³⁶ than the biological ones, though the machines he anticipated were no less corporeal than Moreau’s humanized animal experiments or the Martians that attack Woking. In the first chapter of *Anticipations*, “Locomotion in the Twentieth Century,” he repeatedly described modern vehicles as replacements for their biological predecessors: “Before every [railway] engine, as it were, trots the ghost of a superseded horse, refuses most resolutely to trot faster than fifty miles an hour, and shies and threatens catastrophe at every point and curve.”³³⁷ Wells approved of this sort of evolution and saw in it a future that could not obtain soon enough. Moreover, he resented what he saw as animal bodies’ undue influence on the designs of England’s modern urban structures; since the modern machine had abrogated the laboring animal body, society could be reordered according to whatever dimensions were most

³³⁴ H. G. Wells, *The Discovery of the Future* (New York, NY: B. W. Heubsch, 1913), 5-6.

³³⁵ Wells, *Discovery of the Future*, 6-7.

³³⁶ H. G. Wells, *Anticipations of the Reaction of Mechanical and Scientific Progress Upon Human Life and Thought* (

³³⁷ Wells, *Anticipations*, 7.

useful to humans, their beasts of burden no longer being necessary. “Few people saw in the locomotive anything but a cheap substitute for horseflesh,” Wells criticized, “or found anything incongruous in letting the dimensions of a horse determine the dimensions of an engine.”³³⁸

Clearly he preferred corporeal machines to animal bodies because they could be bent more easily and quickly to a progressive social vision.³³⁹

As Wells would point out in *The Land Ironclads* (1903) however, not all mechanical progress aimed at some utopic apex, for ‘progress’ also applied to warfare, which might—and a decade later, *did*—just as easily plunge human civilization into the imbroglio of a devastating war. In *The Land Ironclads*, the mechanimal body supplants the war-trained animal for the first time in Wells’s *oeuvre*. The story is told from the perspective of a war correspondent following a platoon of battle-hardened troops.³⁴⁰ Supported by cavalry, they dig in to defend their border against an invading army comprised of, as they see it, untrained civilians, cosmopolites that are not used to the hard conditions of the battlefield and are constitutionally ill-equipped to fight. And then they see “a large and clumsy black insect, an insect the size of an ironclad cruiser, crawling obliquely to the first line of the trenches and firing shots out of portholes in its side.”³⁴¹ The “insect” continues to move “regardless of the hail [of rifle fire] that splashed its skin with bright new specks of lead”; nor is it the only one, for soon the correspondent has a “vision of the

³³⁸ Wells, *Anticipations*, 6.

³³⁹ A productive study might be done on the fantasies of what is bodily possible that are implied by the mechanical bodies that Wells imagined. A similar study, albeit one focused on humanoid machines, appears in “The Mechanical Body,” chapter two of Despina Kakoudaki, *Anatomy of a Robot: Literature, Film, and the Cultural Work of Artificial People* (New Brunswick, NJ: Rutgers University Press, 2014).

³⁴⁰ H. G. Wells, “The Land Ironclads,” *The Oxford Book of Science Fiction Stories*, ed. Tom Shippey (Oxford, England: Oxford University Press, 2003), 5.

³⁴¹ Wells, “Land Ironclads,” 7.

hillside of trench being rushed by a dozen vast cockroaches.”³⁴² The defending cavalry rush the machines but are quickly dispatched: here is the moment when Wells offered the world a vision of the mechanical’s abrogation of the animal. The war correspondent sees “all these burly, sun-tanned horsemen, disarmed and dismounted and lined up... their horses unskillfully led away by the singularly not equestrian cyclists to whom they had surrendered,” and they stand, “truncated Paladins, watching this scandalous sight.”³⁴³ No less a romance than medieval works like *Sir Gawain and the Green Knight*, *The Land Ironclads* nevertheless replaces the martial emissary with modern men and his horse with a machine that twenty-first-century readers easily recognize as a prototype of the tank, albeit described in insectine terms.

But both *Anticipations* and “The Land Ironclads” imagined future war material and their consequences in No Place. Wells told his friend Arthur Bennett that the detached perspective of *Anticipations* “gives you no inkling of the massive culminating effect of the book as a whole.”³⁴⁴ From this comment we can surmise that Wells sought to write the modern future as an epic culminating in an apocalypse. War became an important subject for him after *Anticipations*, affording sublime views of monstrous machines, the killing of which made for legendary reading. Moreover, war’s tendency to intensify in increasing conflict made sense of technological progress, and technological progress in turn suggested some future technological apex, an apocalypse that would end the death drive; whether or not what remained would be utopic was still a question.

³⁴² Wells, “Land Ironclads,” 10-11.

³⁴³ Wells, “Land Ironclads,” 20.

³⁴⁴ J. R. Hammond, *An H. G. Wells Chronology* (London, England: Macmillan Press, Ltd., 1999), 41.

In this and several other biographical details we see a Wells who lived out the contradiction of desiring to imagine the finest details of war while also vociferously opposing it. Some scholars have resolved this contradiction by reading Wells as a prophet, but the fact is, for him, *imagining* war was good business. *Anticipations* earned him an audience with Winston Churchill; the threat of war always raised the questions of who, where, and when, and answers to those questions made for interesting reading; he even published two books on war games that could be played on the living room floor with materials found around the house.³⁴⁵ At the dawn of screened entertainment, in a time before video games, Wells was making money entertaining people with all the themes that characterize popular speculative and science fiction in new media. *The War in the Air* should be read in terms of all of these major themes, then: bodily possibilities, anticipation of future events, and Wells's romantic view of war as some grand game, a sublime sight to be seen from above or from afar.

Summary of *The War in the Air*

Much of Wells's corporeal thinking in the decade leading up to writing *The War in the Air* informs his depictions of the world's flying-machines. The story opens on an age that is increasingly locomotive:

“The motor-cars that went by northward and southward grew more and more powerful and efficient, whizzed faster and smelt worse; there appeared great clangorous petrol trolleys delivering coal and parcels in the place of vanishing horse-vans... And then young Bert

³⁴⁵ H. G. Wells, *Floor Games* (Boston, MA: Small, Maynard, and Company, 1912). See also the sexistly-titled H. G. Wells, *Little Wars: A Game for Boys from Twelve Years of Age to One Hundred and Fifty and for That More Intelligent Sort of Girls Who Like to Boys' Games and Books* (Boston, MA: Small, Maynard, and Company, 1913).

Smallways”—Wells’s protagonist, a mechanic—“got a motor-bicycle...”³⁴⁶ Smallways becomes fond of weekend excursions and on one such outing with his girlfriend Edna, through a comedic turn of events, he accidentally flies away in someone else’s balloon; as it happens, that someone else is Alfred Butteridge, an internationally famous inventor, who has invented and publicly demonstrated a heavier-than-air flying-machine. Butteridge routinely describes himself as “an ‘Imperial Englishman,’ and his first wish and his last was to see his invention the privilege and monopoly of the Empire.”³⁴⁷ But there is a catch: Butteridge’s personal life includes “a love affair of large and unusual dimensions and irregular circumstances,” such that his celebrity cannot easily be accepted by a “still largely decorous British public.”³⁴⁸ Acceptance, however, is the price Butteridge puts on the Empire’s acquisition of the flying-machine, and the need is dire as wars with Germany and Japan are afoot.

When Butteridge’s balloon takes off with Smallways in the gondola, the latter discovers documents in the pocket of a fur coat he has donned to keep warm at altitude. Among the documents are the blueprints for the Butteridge flying-machine and letters from Germany; Smallways surmises they are from a private company, not the German government, but nevertheless concludes that Butteridge has been in talks with German elements about selling his machine in case the deal with the British Empire falters.³⁴⁹ The balloon drifts east, out over the

³⁴⁶ H. G. Wells, *The War in the Air*, ed. Patrick Parrinder (New York, NY: Penguin Books, 2005), 7.

³⁴⁷ Wells, *The War in the Air*, 22.

³⁴⁸ Wells, *The War in the Air*, 22.

³⁴⁹ The documents include the words “*Drachenflieger*. *Drachenballons*. *Ballonstoffe*. *Kugelballons*.” Parrinder’s edition includes a note that *drachenflieger*, “Literally ‘Dragon-flyer,’” is a “coined word for ‘aircraft.’” See Wells, *The War in the Air*, 286. However, Wells may have been referring to the Kress Dragon Flyer described in No Author, “The Kress Dragon Flyer,” *The Aeronautical Journal* V:18 (1901): 27. At the time this article was published the Kress Dragon Flyer was a pontoon craft towed by kites for want of an internal combustion engine, owing to Kress’s lack of funding. He had used the interim period to test the craft’s handling. The article’s author indicated that “Herr Kress thinks that the moment of rising may come unawares.” Cf. Wells, *The War in the Air*, 15, where he describes “the final boom of flying” as beginning “like the coming of a breeze on a quiet day.” The writer describing Kress’s machine continues: “The ship may, of its own accord, leave the water,” a turn of phrase that

clouds, and Smallways looks out and sees “three long, dark shapes like hurrying fish that drove one after the other, as porpoises follow one another in the water. They were very fishlike indeed—with tails.”³⁵⁰ The balloon wanders lower, making Smallways appear “a solitary balloonist—replacing the solitary horseman of the classic romances... wending his way across Franconia,”³⁵¹ a German province, until it is shot down at an aeronautics park. The park is home to a fleet of German airships, “the lineal descendants of the Zeppelin airship,” which Wells described in anatomical terms: with “a horizontal lateral fin on either side,... two vertical fins, which normally lay back like gill-flaps on either side of the head. It was a most complete adaptation of the fish form to aerial conditions, the position of swimming bladder, eyes and brain being, however, below instead of above” each airship’s “central backbone which terminated in the engine and propeller.”³⁵²

Smallways assumes Butteridge’s identity and assumes he will be welcomed as a hero for bringing the plans for the Butteridge flying-machine, which he offers in an effort to save his own skin. He is whisked away with the German Air Fleet under the command of Prince Karl Albert, “the War Lord, the hero of two hemispheres.”³⁵³ The Prince views modern vehicles with all the romance of yesteryear, and rides forth with his fleet to extend the boundaries of the German Empire by attacking New York. Smallways knows nothing of his plans, however, and continues his ruse as Butteridge alongside Lieutenant Kurt, an English-speaking German soldier ordered to accompany him. Predictably, the Prince discovers Smallways’s secret *en route* to New York

recalls Verne’s *oeuvre*, across which the *Nautilus* evolved into the *Albatross*, which in turn would evolve into the *Terror* a scant four years after the article on Kress was published.

³⁵⁰ Wells, *The War in the Air*, 59.

³⁵¹ Wells, *The War in the Air*, 68.

³⁵² Wells, *The War in the Air*, 70-71.

³⁵³ Wells, *The War in the Air*, 89.

and, based on a forensic investigation of Smallways's balloon, concludes that he has accidentally drifted into Germany, which the Prince sees as an act of divine Providence. He allows Smallways to remain alive and aboard his airship, the *Vaterland*, as ballast, "until it is convenient to dispose of" him.³⁵⁴

Over the Atlantic, the German Air Fleet engages the United States Navy, decimating the American Atlantic Fleet *en route* to the East Coast. Wells described this skirmish as "the first fight of the airship and the final fight of those strangest things in the whole history of war: the ironclad battleships... Surely they were the weirdest, most destructive and wasteful megatheria in the whole history of mechanical invention."³⁵⁵

Leaving the Atlantic Fleet's sailors and ships dead in the water, the German Air Fleet commences its attack on New York City, which Wells painted as unruly, barely governable, always on the verge of rebellion. Advised by Washington to surrender, New York's implicitly Irish mayor, O'Hagen, resists nonetheless. The ungovernable citizens of the Big Apple seize the opportunity to rush and burn one of the German airships, which has had to land at Staten Island for repairs. Wells notes that the airship lacks the capacity to carry an invasion force, and so it succumbs; neither have the other German airships any soldiers with which to conquer New York. Instead, the Prince sets about bombing the city into oblivion. In the illustrations published in the first edition of *The War in the Air*, this scene looks almost sub-aquatic, with smoke rising from buildings that burn in the haze below and airships looming through the murk. In the midst of this battle, the *Vaterland* is caught in an aerial skirmish with an American airship, its engines are disabled, and it is blown off course. As Kurt describes it to Smallways later, "One of [the

³⁵⁴ Wells, *The War in the Air*, 101.

³⁵⁵ Wells, *The War in the Air*, 121-122.

Americans'] infernal things dropped out of the air on us and rammed... simply ripped the after gas-chambers like gutting herrings, crumpled up the engines and screw."³⁵⁶



Figure 8: German airships looming through the murk of a burning New York City

After the *Vaterland* is disabled, the Prince's crew transfers to another ship, the *Hohenzollern*, and resupplies; Smallways remains on the ground, a conscript of the German supply lines. Meanwhile, out of the western sky comes an "Asiatic" invasion force, "the Southern fleet of the Asiatics," with its own designs on the United States, and the Germans are forced to fight for what they have already begun to conquer; the two fleets join combat over Niagara Falls. The Asiatic airships are also "fish-shaped, but not so much on the lines of a cod or goby as of a ray or sole,"³⁵⁷ i.e., they present a narrower profile to their assailants. Moreover, some four hundred "one-man flying machines"³⁵⁸ ride on their flanks until they are within range,

³⁵⁶ Wells, *The War in the Air*, 158.

³⁵⁷ Wells, *The War in the Air*, 182.

³⁵⁸ Wells, 187.

then deploy, targeting the German airships with explosives designed to rupture their envelopes and bring them crashing to the ground. The entire cloud of confused combat rises “like a swarm of big butterflies” over Niagara, with the German ships flying in formation, “a compact phalanx” which gradually becomes the main focus of the Asiatic attack. From the ground, Smallways watches in wonder and terror as “out of the south, riding like Valkyries swiftly through the air on the strange steed the engineering of Europe had begotten upon the artistic inspiration of Japan, [comes] a long string of Asiatic swordsmen,”³⁵⁹ “like a swarm of attacking bees,”³⁶⁰ that slowly overcomes the German Fleet and its makeshift ground support.

When they finally succumb, the violence becomes personal for Smallways. At first, he is conscripted by the Prince, who has discovered his mechanical skills and insists that he help repair a downed Asiatic fighter craft. While working, he finds a gun in another downed Asiatic fighter nearby and bides his time until, at long last, conflict with the Prince escalates and Smallways shoots him. With the Asiatic fighter now repaired, he flies away to Upstate New York, to a village that has returned to local rule on account of attacks all over the country. In a bar room conversation, Smallways reveals he has captured one of the Asiatic flying-machines, is told how Britain and the United States nearly averted disaster with the Butteridge machine, plans for which were lost at sea by some accident. Smallways triumphantly produces the plans from a breast pocket, and he and a townsman, Laurier, mount bicycles and ride to deliver the plans to a town called Pinkerville, to which the President has retreated, presumably in the wake of an attack on Washington.

³⁵⁹ Wells, 190.

³⁶⁰ Wells, 194.

After delivering the Butteridge plans to the President, Smallways finds passage to England aboard a ship, on which he serves as a member of the crew. The ship is chased by an Asiatic ironclad, ends up off course in the Canary Islands and has to be repaired, puts in at Morocco and Smallways and the crew are almost taken hostage, is wracked with “Purple Death,” which kills all but four of the crew, and only eventually, a year later, arrives in England. Smallways finds his home country changed, a quasi-medieval patchwork of inter-village politics bereft of police presence. On a long walk home through Oxford, “powerful motor-cars containing masked and goggled figures went tearing past him. There were few police in evidence, but ever and again squads of gaunt and tattered soldier-cyclists would come drifting along... Amidst all the wreckage they were still campaigning.”³⁶¹ Upon returning home, Smallways kills a town bully who fancies Edna for himself, and the story ends as he reminisces on the entire transatlantic adventure thus: “somebody somewhere ought to have stopped something, but who or how or why were all beyond his ken.”³⁶²

Mechanical Politics in *The War in the Air*

The War in the Air was published during a period in which Wells’s vision of a World State matured, the years between 1900 and 1920, which led up to his joining the British Ministry of Propaganda in 1918. It therefore makes sense to read *The War in the Air* as a powerful piece of propaganda written to persuade the United States—both its people and its leaders—to take on the work of developing mechanicals to help usher in the World State, which was, in a technological sense, to take up Kipling’s “White Man’s Burden.” *The War in the Air* persuaded through a

³⁶¹ Wells, 258.

³⁶² Wells, 276.

combination of alluringly wondrous vehicular phenomena and the terrifyingly sublime prospect of mechanimal-driving Other races.

Above I have summarized *The War in the Air* in a way that shows how thoroughly Wells integrated the mechanimal vision with the story's plot and politics—it was integral to his vision for the modern future, particularly for a future World State. Smallways's journey is geographically improbable, at best, but his circuitous route constitutes a metamorphosis of vehicular embodiment that permitted Wells to portray a phantasmagoria of vehicular phenomena. Smallways sees the world from a motorbike, a balloon, an airship, a *drachenflieger*, a bicycle, a ship, and then once again on foot. Even from the story's beginning Smallways seeks out new vehicular experiences, is “filled with ideals of speed and enterprise... Even a road-racer, geared to a hundred and twenty [miles per hour], failed to satisfy him, and for a time he pined in vain at twenty miles an hour along roads that were continually more dusty and more crowded with mechanical traffic.”³⁶³ Although Butteridge, not Smallways, is the first character to fly in *The War in the Air*, Wells portrays Butteridge's flight from the perspective of the ground, of those looking up at his feat in awe of the impending future: “A man was flying securely and well. Scotland was agape for his coming” on the first flight from the Crystal Palace to Glasgow.³⁶⁴ However, the reader first experiences the world from the air through the Smallways-eye view, and Smallways's perspective frames the story's vehicular phenomena.

³⁶³ Wells, *The War in the Air*, 10.

³⁶⁴ Wells, *The War in the Air*, 20. This view from the ground is common in early-twentieth-century British literature, particularly in writing that portrays the Zeppelin, among them Virginia Woolf's, D. H. Lawrence's, and Ford Maddox Hueffer's. For the most comprehensive overview of British writers' portrayals of the Zeppelin, see Ariela Freedman, “Zeppelin Fictions and the British Home Front,” *Journal of Modern Literature* 27:3 (Winter 2004): 47-62.

Smallways happens into his first flight comedically. Butteridge's lady friend faints while debarking from a balloon gondola on a crowded beach; Butteridge struggles to catch her without releasing the untethered balloon; Smallways, an onlooker, rushes to help but falls into the gondola while the lady wakes and flails and falls out of it; the balloon, free of its original passengers, who are a portly couple, launches upward with Smallways in its basket. As Wells described Smallways's takeoff, "his impressions were complex."³⁶⁵ Once the accidental aeronaut extricates himself from a pile of discarded clothing at the bottom of the gondola and stands up, through his eyes the reader sees the world from the air for the first time: "Below him, far below him, shining blue, were the waters of the English Channel. Far off, minute in the sunshine, and rushing down as if someone was bending it hollow, was the beach and the irregular cluster of houses that constituted Dymchurch... the balloon, released from the twenty-five stone or so of Mr. Butteridge and his lady, was rushing up into the sky at the pace of a racing motor-car."³⁶⁶ The chaos of this scene leaves little room for reflection on the ground below. By portraying Smallways's phenomena this way, Wells recapitulated the suddenness with which aviation overtook Britain. Comedic though this episode is, Smallways is launched into the unknown, evoking the danger of being overtaken by a new mode of locomotion, of being carried away by something that one does not understand and is unprepared to control. Wells's subsequent comments on Blériot's crossing indicate that this is exactly how he saw the British, and to an American readership it reads as a warning lest the people of the United States should also be taken unawares by a technological revolution.

³⁶⁵ Wells, *The War in the Air*, 49.

³⁶⁶ Wells, *The War in the Air*, 50.

This warning sets the tone for the rest of the story. In contrast with the balloon's uncontrollable chaos, Wells used the perspective from a German airship, a vehicle that can be steered and even flown against the wind, to orient the reader to social order. When Smallways initially departs in the *Vaterland*, the aeronautical park stretches out below the ship, "dimly geometrical in the darkness."³⁶⁷ This is *German* order—not English or American order. By contrast, from the air, England looks chaotic, unplanned, disorderly. As they fly over, Smallways notes the "multitude of factories and chimneys... old railway viaducts, monorail networks and goods yards, and the vast areas of dingy homes and narrow streets, spreading aimlessly, struck him as though Camberwell and Rotherhithe had run to seed. Here and there, as if caught in a net, were fields and agricultural fragments. It was a sprawl of undistinguished population"³⁶⁸ and a hodgepodge of architectural history. This is order in transition from agrarian to industrial according to no particular plan; modernity is happening to England and not the other way around. Germany, not England, has the view from above that good social planning requires, and has already used it to order its own society.

Before the German fleet attacks New York City, there is "a pause of mutual inspection"³⁶⁹ when the citizens stare up at the Zeppelins and Smallways and the Germans stare down at the city below. From this aerial perspective, Wells's portrays New York as the superlative modern city.

No city in the world was ever so finely placed as New York, so magnificently cut up by sea and bluff and river, so admirably disposed to display the tall effects of buildings, the complex immensities of bridges and monorailways and feats of engineering. London, Paris, Berlin were shapeless, low agglomerations beside it. Its port reached to its heart like Venice[‘s], and like Venice it was obvious, dramatic and proud. Seen from above it

³⁶⁷ Wells, *The War in the Air*, 86.

³⁶⁸ Wells, *The War in the Air*, 103.

³⁶⁹ Wells, *The War in the Air*, 134.

was alive with crawling trains and cars, and at a thousand points it was already breaking into quivering light. New York was altogether at its best that evening, its splendid best.³⁷⁰

Here, again, is the wonder of the view from above, from which Wells gives his American readers an elevated glimpse of their culture's ascendancy: New York is an icon of cultural opulence.

Here Wells's flattery from *The Future in America* is amplified by the wondrous aerial view.

But in this aerial view New York is the object, both of an impending German attack and of the English Wells's propagandistic forecasting—both European empires work on the hearts and minds of American readers simultaneously. The wonder of New York gives way to terror as, with Smallways still looking on, the city comes under fire from the German Air Fleet, is decimated, surrenders, then thinks the better of it and revolts, even though the revolt is futile since the German airships are able to simply fly away, leaving devastation in their wake. Within the world of the story Germany's Zeppelin's have done their worst, and beyond the pages of *The War in the Air* Wells has left American readers with the impression that one of their most remarkable cities was prone to attack.

Clearly, Wells intended for *The War in the Air* to read as a worst-case scenario of the global violence that would erupt if the United States did not develop futuristic flying-machines to deter Germany militance. However, the racism and xenophobia he deployed in persuading American readers exacerbated tensions between the U.S., Germany, and Japan, and these tensions had the potential to erupt into the very sort of aerial world war Wells professed a desire to avert. The shift from wonder to terror when the Zeppelins attack New York marks the point at which the reader's awe at the modern future turns to fear of the possibility that some 'barbaric' nation or race might be first to develop flying mechanical vehicles. True to his general

³⁷⁰ Wells, *The War in the Air*, 135.

perception of English culture, Wells wrote the British Empire as so far behind it must anxiously rely on acquiring the Butteridge design; but the plans are lost to England when Smallways accidentally flies away in Butteridge's balloon. The United States is already a nation on the move, well organized compared to England, but it has not yet developed flying mechanicals; it has only a few machines modeled on the Wrights' biplanes. The implication that Smallways turns over the lost Butteridge plans to the American President offers the only glimmer of hope for an eventual restoration of modern order to a world that has been plunged into a political dark age.

After Germany's attack on New York comes a counter-attack from a superior 'Asiatic' air fleet that has its own imperial designs on America. As Wells imagined it, "The Asiatic invasion of America completely effaced the German-American conflict"³⁷¹; it "left the visible world"—that is, the North American continent—"to Asia, to yellow people beyond Christendom, to all that was terrible and strange!"³⁷² Wells's mechanicals connote the Asian fleet's technological superiority, but also frame their cultures as alien.

The connotation of the Asian fleet's technological superiority follows the Vernian logic of biomorphism permuted with the modern value of "the New." First, it bears mentioning that the Americans have a flying-machine, but compared to the biomorphic shapes of the German and Asian airships it is a crude contrivance. This contrast appears in one of the plates in the first edition of *The War in the Air*, a drawing that depicts two American flying-machines attacking a rolling whale of a German airship. Compared with the airship's fluid lines and luminous skin,

³⁷¹ Wells, *The War in the Air*, 181.

³⁷² Wells, *The War in the Air*, 196.

the American flying-machines are pole-framed boxes, little more than gunnery platforms that

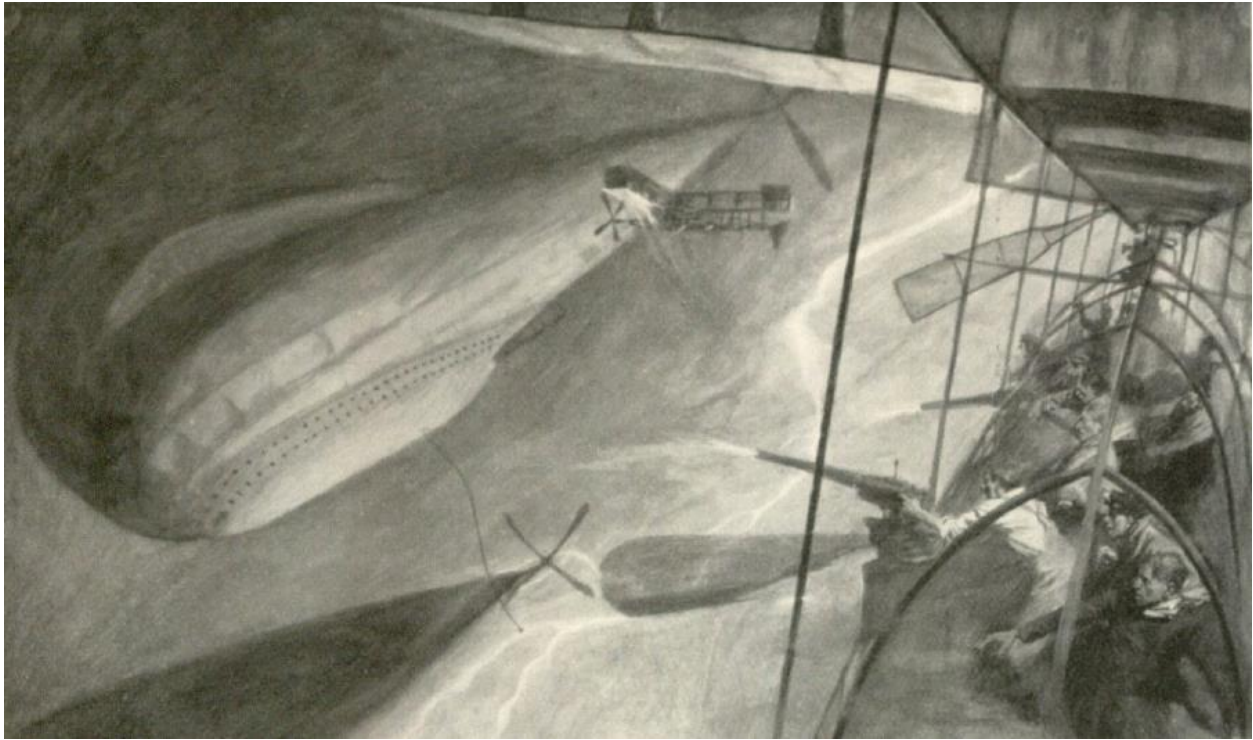


Figure 9: Two American flying-machines attack a cetacean German airship

somehow miraculously fly. Clearly, America is barely a competitor in a contest for air superiority. By contrast, in a plate depicting a German airship's crash into Niagara Falls, the Asian fighter craft that assail it are depicted as small, light, fast, sharp, and flying in formation. They have "curiously curved, flexible side wings, more like *bent* butterfly's wings than anything else, and... a long humming-bird tail."³⁷³ Wells describes them further as bat-like,³⁷⁴ as "like great midges,"³⁷⁵ and as hovering "like a swarm of attacking bees."³⁷⁶ Their bird-like pinions are almost angelic and are not fixed like even twenty-first-century fighters, but instead appear to flap

³⁷³ Wells, *The War in the Air*, 183.

³⁷⁴ Wells, *The War in the Air*, 175.

³⁷⁵ Wells, *The War in the Air*, 195.

³⁷⁶ Wells, *The War in the Air*, 194.

like the outstretched wings of birds of prey. According to a Pettigrewian logic of animal locomotion, though the German airships are patterned after swimming creatures in a world where swimming is a kind of underwater flight, the Asian fighters are patterned after flying species and are better evolved for aerial locomotion.



Figure 10: A German airship downed by biomorphic Asiatic fighter craft

This more-evolved design redeploys Verne's association of biomorphism with futurism: the better evolved a mechanimal is for moving through the element it traverses, the more futuristic a technology it is. According to this logic, then, *The War in the Air*—and its earliest illustrations were instrumental in this—established a hierarchy of world powers' evolved-ness: America was flying but crudely; Germany was flying more sophisticatedly but not as efficiently as possible; and Asia,

thanks to Japanese ingenuity and Chinese industriousness, was flying as the birds do, which is to say in the most evolved way imaginable at the time.

The depiction and description of Asian machines and the species with which Wells associated them all connoted a multitude too numerous to count operating according to a logic alien to Western chivalry and to Christendom. As bat-like, the Asian machines resonate as demonic thanks in no small part to Greer's *A Modern Daedalus*, and their insectine swarm behavior has long since become a hallmark characteristic of alien species in science fiction literature, film, and television. The close association between insects and swarms amplifies this alienness by defacing the individual amid a horde, which confronts the Western literary tradition of the heroic individual that can be traced at least as far back as Homer's *Iliad*.

The cultural strangeness of these mechanimal descriptions was calculated to evoke American fears of attack, particularly from Asia, and Wells amplified the terror of being out-evolved by lacing these episodes of mechanimal invasion with xenophobic invective. Wells elided the cultural differences between China and Japan under the term "Asiatics" and then deployed familiar stereotypes to amplify already-established fears American readers had about Asian races. The Asian airships have been manufactured in China, in the "great aeronautic parks at Chinsi-fu and Tsingyen," by "a limitless supply of skilled and able workmen, workmen far above the average European in industrial efficiency."³⁷⁷ Here is an echo of nineteenth-century American stereotypes of Chinese laborers, who had incurred resentment for 'taking jobs' from white men working on the railroads. Moreover, by portraying the labor force of Asia as more efficient and more numerous than the laborers of modern Europe and the U.S., Wells played upon capitalist fears of labor unions, and on labor unions' fears of losing jobs to immigrant

³⁷⁷ Wells, *The War in the Air*, 174. Hough sees this as just one instance of the trope of "the rise of a Sino-Japanese superpower (Japanese technology married to Chinese manpower) imperiling Western civilization," which appears elsewhere, e.g. in Jack London's 1907 story, "The Unparalleled Invasion." See Kenneth Charles Hough, "Rising Sun Over America: Imagining a Japanese Conquest of the United States, 1900-1945" (dissertation, University of California, Santa Barbara, 2014), 72.

workers who would accept lower wages. Capitalist fears of foreign invasion would have been further exacerbated by Wells's portrayal of attacks on major centers of modern capital, such as "the oil wells of Cleveland" or Goat Island, which was then home to Tesla's and Westinghouse's famous hydroelectric plant, the first of its kind.³⁷⁸

In the aftermath of *The War in the Air* modernity degenerates unevenly. The disruption of infrastructure and scientific inquiry results in unsanitary conditions and a lack of medical research, such that the planet is wracked by a plague, the "Purple Death," an implicit reference to M. P. Shiel's *The Purple Cloud*. One symptom of this pestilence is jaundice and Wells repeatedly describes those affected as "yellow-faced,"³⁷⁹ terrifying his white readers at the possibility that without scientific medicine some bacillus might change their appearance so that they resembled their 'Asiatic' enemies. In those who have succumbed to it, this yellowness accompanies other characteristics that imply their threat to social order or their complicity in the degeneration of modernity. They are "shrunken" and "in a moral apathy,"³⁸⁰ "negligently dressed and armed—prowling for food. These people would have the complexions and eyes and expressions of tramps or criminals, and often the clothing of prosperous middle-class or upper-class people."³⁸¹ The description of these victims' clothing would have evoked, alternately, fear of revolution and fear of the degeneration of even those whose labor had established and sustained the social order before the war.

³⁷⁸ Wells, *The War in the Air*, 198-199.

³⁷⁹ Wells, *The War in the Air*, 253-256.

³⁸⁰ Wells, *The War in the Air*, 253.

³⁸¹ Wells, *The War in the Air*, 256-257.

Wells's Mechanimals and the Fascism of His World State Vision

An aftermath scene in which a 'Chinaman' is hanged by a group of men in "a peaceful-looking village,"³⁸² for stealing from a railroad shed, reads as gratuitous violence arbitrarily aimed at a racial and national other. It is unclear what crime prompted this execution, what prejudices led to such a drastic conclusion. Also, the casual, racist elision of difference commonly performed by the word "Chinaman" in the early nineteenth century raises myriad questions. Was the executed man really from China, a marooned soldier left behind by his air group, or was he an American of Chinese or some other Asian descent whom the townsfolk took an opportunity to excise from their social order? Without any answers, this man is reduced to an object of unintelligible violence, prompting reflection on why he needed to be a 'Chinaman' in order to convey the disorderliness of the social fabric of post-War in the Air America.

Nor is the social fabric of England any more orderly. When Smallways finally returns to England he discovers its cities have devolved into chaos and its towns have become self-enclosed civilizations.

In one parish he would find the large house burnt, the vicarage wrecked, evidently in violent conflict for some suspected and perhaps imaginary store of food, unburied dead everywhere, and the whole mechanism of the community at a standstill. In another he would find organizing forces stoutly at work, newly painted noticeboards warning off vagrants, the roads and still cultivated fields policed by armed men, the pestilence under control, even nursing going on, a store of food husbanded, the cattle and sheep well guarded, and a group of two or three justices, the village doctor or a farmer, dominating the whole place; a reversion, in fact, to the autonomous community of the fifteenth century.³⁸³

Here aerial war has reduced modernity to medieval feudalism once again. This should have been sufficient to show the dire possible outcome of aerial war, but Wells added a racist flourish of continuous aerial danger: "But at any time such a village would be liable to a raid of Asiatics or

³⁸² Wells, *The War in the Air*, 244.

³⁸³ Wells, *The War in the Air*, 257.

Africans or suchlike air-pirates, demanding petrol and alcohol or provisions.”³⁸⁴ Why must these raiders be racially other when Wells had already demonstrated that there was sufficient disorder within England alone to account for raiding parties without resorting to race? The only viable explanation is that he felt an urgent need to convince an Anglophone readership, particularly Americans, that the pirates of the colonized world would come raiding if the modern West—more to the point, ‘the white man’—did not develop flying-machines first.

Read against this social degeneration, Wells’s mechanimals present the reader a choice between two competing visions of the future. On the one hand, mechanimals could be used to establish a progressive geopolitical order, a modern utopia where technologies are patterned after the ‘machines’ found in nature and informed by scientific insight that leads to human flourishing. On the other hand, mechanimals could be used to wage a global war that might last for generations and plunge the world into a Dark Age, resulting in the degeneration of what, Wells believed, European nations and the United States were all working toward. In the first case, mechanimals would be the wonders of the new modern future. In the second, they would be the degenerate forms assumed by human barbarians,³⁸⁵ the tools that colonized races would wield vengefully over Europe’s once-modern former empires.

By posing this dilemma Wells clearly wanted American readers to decide for an opulent modernity and contribute American industrial production and military might to an effort at world

³⁸⁴ Wells, *The War in the Air*, 257.

³⁸⁵ The degenerate mechanimal also appears in the most famous work by Wells’s friend Joseph Conrad, *Heart of Darkness*. As Marlowe narrates: “I came upon a boiler wallowing in the grass, then found a path leading up a hill. It turned aside for the boulders, and also for an undersized railway-truck lying there on its back with its wheels in the air. One was off. The thing looked as dead as the carcass of some animal.” Conrad emphasizes the mechanimal’s mechanicity, such that the premodernity of the ‘dark’ parts of the world reduces the mechanimal to a carcass. By contrast, Wells emphasized the mechanimal’s animality, such that in his stories the premodern parts of the world were capable of designing and building mechanimals, although, without the technological elegance brought about by science, he imagined their constructions as crude and bestial. See Joseph Conrad, *Heart of Darkness* (New York, NY: Penguin Classics, 2007), 18.

peace with the goal of forming a World State. Should the Americans demur, though, *The War in the Air* implies that, in the event another modern nation develops machines that can fly long distances, not even the United States will be safe from modern war. If left without an aerial fleet of its own, America would eventually fall victim to some international aggressor's airships, with which an enemy would certainly wreak barbarous havoc on its commercial and industrial centers, crippling the nation's transportation, communication, and economic networks. Wells's choice of America's fictitious enemies was shrewdly calculated to set American popular opinion against England's enemies. By 1908 the English were deeply concerned about an increasingly industrial, increasingly imperialistic Germany, and all of Europe had become aware of China's strength in the Boxer Rebellion of 1900-1901. By stoking fear of these two countries in particular, Wells not only advocated the development of the mechanical vehicles necessary for forming a World State, he primed American readers for an alliance with England by turning attention to their mutual enemies.

Another problematic facet of Wells's portrayal of Asian races is that this geopolitical subtext of *The War in the Air* reiterates a fascist future vision that had already been offered by Kaiser Wilhelm II himself. John Gray has noted that "In the years before the Second World War, Wells's view of fascism was not always wholly negative. He, too, dreamt of government by an intelligent minority, and throughout the film 'the people' appear as an ignorant, prejudiced, Luddite rabble."³⁸⁶ Given that Wells was repeating the Kaiser's vision, it is difficult to separate his and "the rabble's" prejudice and ignorance. The geopolitical vision that motivates *The War in the Air* echoed Kaiser Wilhelm II's own forecast from 1907 that "in the coming conflict between Japan and America, England would have to side with the latter since this was 'a

³⁸⁶ John Gray, "Fictions of Fascism," *New Statesman* 146:5356 (3-9 March 2017): 40-43.

question of Race, not of Politics, only *Yellow* versus *White*'. The British newspapers, he noted with satisfaction, had 'for the first time used the term "Yellow Peril" *from my picture*, which is coming true."³⁸⁷ Here the Kaiser was referring to his 1895 painting, *Völker Europas, wahrt eure heiligsten Güter!* (*Peoples of Europe, Keep Your Holiest Goods!*), which, according to John Röhl, "shows the nations of Europe as pre-historic warrior-goddesses being led by the Archangel Michael against the 'yellow peril' (represented by a buddha) in the east."³⁸⁸



Figure 11: A reprint of Kaiser Wilhelm's *Völker Europas, wahrt eure heiligsten Güter!* (*Peoples of Europe, Keep Your Holiest Goods!*) from *Harper's Weekly* (1903)

³⁸⁷ John Röhl, *The Kaiser and His Court: Wilhelm II and the Government of Germany* (Cambridge, England: Cambridge University Press, 1994), 203-204. Emphasis here is Röhl's.

³⁸⁸ Röhl, 204.

Among OED's definitions of "fascism" is "Behaving in a manner perceived as autocratic, intolerant, or oppressive; advocating a particular viewpoint or practice in a manner that seeks to enforce conformity; (also) characterized by behaviour of this kind."³⁸⁹ Wells's writing and the TED Talks cited in the introduction to this dissertation compel the questions: To what extent can wonder force people toward conformity? To what extent can terror do so? One problem in Wells discourse is that scholars are still reticent to address the inherent fascism of his vision of a World State, which means that his vision of a modern future ordered on the power of animalized machines goes unquestioned, as does the propagandist nature of much of what he wrote. For example, Cole acknowledges the similarity between Wells's and fascist rhetoric³⁹⁰ but finds his vision of "the saving value of unity" nevertheless worth considering. "Throughout these chapters," she concludes, "we have found the idea of war's ending lodged in various spaces of the imagination—the war that *will* end war—and these help collate a range of scenarios and open horizons for thinking about peace."³⁹¹ The hopeful note here is admirable, but it downplays Wells's fascist tendencies as "rhetoric" and reopens a positivist view of history that issues in Orwellian doublespeak by essentially arguing that "war [today] is [or will ultimately be] peace."

Wells the 'Prophet' in Wells Scholarship

The future tense of Wells's ideation bespeaks his increasing attempts to self-portray as a prophet, which were part of the propagandistic power he wielded. Whereas one might expect scholars to deconstruct this tendency, Wells scholarship has instead tended to treat his anticipations, including the bodily possibilities he imagined, as prophetic, prescient, prognosticative, or

³⁸⁹ *Oxford English Dictionary* (2020), s.v. "fascism."

³⁹⁰ Cole, 315.

³⁹¹ Cole, 316.

premonitive. To scholars' credit, this tendency comes from a good-faith attempt to read Wells's work on his own self-aggrandizing terms. "The present writer is a prophet by use and wont," he wrote in 1916.

He is more interested in to-morrow than he is in to-day, and the past is just material for future guessing. "Think of the men who have walked here!" said a tourist in the Roman Coliseum. It was a Futurist mind that answered: "Think of the men who will." It is surely as interesting that presently some founder of the World Republic, some obstinate opponent of militarism or legalism, or the man who will first release atomic energy for human use, will walk along the Via Sacra as that Cicero or Giordano Bruno or Shelley have walked there in the past. To the prophetic mind all history is and will continue to be a prelude. The prophetic type will steadfastly refuse to see the world as a museum; it will insist that here is a stage set for a drama that perpetually begins.³⁹²

As this passage suggests, Wells's notion of the 'prophet' was fairly nuanced. In *The Discovery of the Future* (1913) he described 'prophecy' in terms of possibility, connecting his efforts to imagine the future, which came after *The Time Machine* (1895), with his work to envision bodily possibilities, which largely preceded it: "I believe quite firmly that an inductive knowledge of a great number of things in the future is becoming a human possibility. I believe the time is drawing near when it will be possible to suggest a systematic exploration of the future."³⁹³ To Wells, anticipation was merely yet another journey that could be taken by machine. Wells's first attempt at this, the time machine in *The Time Machine*, was imaginary, but as he worked to anticipate, his 'prophetic' books became time machines themselves.

Wells saw such time machines and the 'prophecies' they articulated as ultimately rooted in scientific thinking. In *The Discovery of the Future* he noted that

It is analysis that has given us all ordered knowledge, and you know that the aim and the test and the justification of the scientific process is not a marketable conjuring trick, but prophecy. Until a scientific theory yields confident forecasts you know it is unsound and tentative; it is mere theorizing... And if I am right in saying that science aims at prophecy, and if the specialist in each field is in fact doing his best now to prophesy within the limits of his field, what is there to stand in the way of our building up this

³⁹² H. G. Wells, *What is Coming? A European Forecast* (New York, NY: The Macmillan Co., 1916), 1.

³⁹³ H. G. Wells, *The Discovery of the Future* (New York, NY: B. W. Heubsch, 1913), 33.

growing body of forecast into an ordered picture of the future that will be just as certain, just as strictly science, and perhaps just as detailed as the picture that has been built up within the last hundred years of the geological past?³⁹⁴

Even if we discount Wells's self-aggrandizing posture as a 'prophet,' it is difficult to deny that

Wells saw his anticipations as fair attempts at painting such "ordered pictures of the future."

Whether or not they are strictly scientific, Wells certainly *believed* they were, as evidenced by

passages in which he attempted to connect his visions of the future of human civilization with

evolutionary accounts of natural history. For example:

We look back through countless millions of years and see the will to live struggling out of the intertidal slime, struggling from shape to shape and from power to power, crawling and then walking confidently upon the land, struggling generation after generation to master the air, creeping down into the darkness of the deep; we see it turn upon itself in rage and hunger and reshape itself anew; we watch it draw nearer and more akin to us, expanding, elaborating itself, pursuing its relentless, inconceivable purpose, until at last it reaches us and its being beats through our brains and arteries, throbs and thunders in our battleships, roars through our cities, sings in our music, and flowers in our art.³⁹⁵

For Wells, all human art—the battleship and the modern city included—is an outworking of an

evolutionary history that he believed could be used to foretell what was likely to materialize in

the future.

To critics who took Wells on his own terms and who were writing after World War II,

The War in the Air's once-foreboding tone became a righteous "I told you so," an unheeded

warning from a prophetic voice. In the preface to the 1921 edition of the book, written in the

wake of the Great War in which Germany sent Zeppelin raids against London, Wells confided

that

I am inclined to think very well of myself as I reread the entirely imaginary account of the collapse of civilization under the strain of modern war which forms the Epilogue of this story. In 1907 this chapter was read with hearty laughter as the production of an 'imaginative novelist's' distempered brain. Is it quite so wildly funny today?³⁹⁶

³⁹⁴ Wells, *Discovery of the Future*, 35-36.

³⁹⁵ Wells, *Discovery of the Future*, 49-50.

³⁹⁶ Wells, *The War in the Air*, 278.

In the preface to the 1941 edition, Wells's high view of his own literary achievement issued in an even more vindictive tone as he referred to the 1921 preface: "Again I ask the reader to note the warnings I gave in that year, twenty years ago. Is there anything to add to that preface now? Nothing except my epitaph. That, when the time comes, will manifestly have to be: 'I told you so. You *damned* fools.' (The italics are mine.)"³⁹⁷ Japan's attack on Pearl Harbor came at the end of that year, on 7 December 1941, "a day that will live in infamy," as Franklin D. Roosevelt famously called it.

The tone of these prefaces, and doubtless the eerie timing of the 1941 preface, prompted critics to read *The War in the Air* as evidence of the soundness of Wells's method, as the gift of forward-thinking intrinsic to science fiction, of which Gernsback famously named Wells one of the originators.³⁹⁸ In *The Early H. G. Wells* (1961) Bernard Bergonzi described *The War in the Air* as "a vivid prophecy of the military possibilities of aeronautics... an apocalyptic reflection on the growing likelihood of a major war,"³⁹⁹ a description that resembled W. Warren Wagar's, who held up *The War in the Air* and *The World Set Free* from among Wells's scientific romances as "two pre-1914 prophecies of world war."⁴⁰⁰ Elsewhere, Wagar has referred to Wells as a "prophet of world order."⁴⁰¹

³⁹⁷ Wells, *The War in the Air*, 279.

³⁹⁸ Hugo Gernsback, "A New Sort of Magazine," *Amazing Stories* 1:1 (April, 1926): 3. An electronic copy of this source is available online at <https://archive.org/stream/AmazingStoriesVolume01Number01#page/n3>.

³⁹⁹ Bernard Bergonzi, *The Early H. G. Wells: A Study of the Scientific Romances* (Manchester, England: Manchester University Press, 1961), 21.

⁴⁰⁰ Wagar, *H. G. Wells and the World State*, 95. Hillegas would continue using the term "prophecy" to describe Wells's work in Mark R. Hillegas, *The Future as Nightmare: H. G. Wells and the Anti-utopians* (New York, NY: Oxford University Press, 1967), 60.

⁴⁰¹ Wagar, *Wells and the World State*, 15-16.

One exceptional deployment of this Wells-as-prophet motif is Patrick Parrinder's, which repeats prophetic terminology but evinces a healthy skepticism of Wells's prophetic posture. I read Parrinder's remark that "Wells's actual 'fantasies' of possibility include some which remain interesting only for the predictions they make"⁴⁰²— here he cited "The Land Ironclads" and *The World Set Free*—as a subtle critique of the then-current tone of discipular awe characteristic of Wells scholarship. Parrinder recognized Wells's tendency to describe his own work as prophetic and preserved it as an aspect of his biography: "In Wells the Hebraic notion of the preacher and sage—a literary Moses pointing the way to his own version of the Promised Land and warning of dire consequences if his message is unheeded—is overlaid with the classical images of the Delphic priestess, sphinx, and Sibyl."⁴⁰³ Although I would argue this is giving the story (and Wells) far too much credit, Parrinder has preserved a sense that Wells was posturing and has also maintained his own critical distance.

Much more recently, in his introduction to the Penguin edition of *The War in the Air*, Jay Winter has described it as "a premonition of what could happen when technology developed more rapidly than the capacity of statesmen to control its destructive potential."⁴⁰⁴ Late last year, Sarah Cole associated *The War in the Air* with Wells's "famous prescience about the future of war and its technologies," which she sees as part of Wells's "calling" to imagine war, which extends to the reader the duty to empathize: "In the case of war, to be able to imagine the horrors and other material aspects of warfare is, in essence, the first duty of the noncombatant. It is a

⁴⁰² Patrick Parrinder, *H. G. Wells* (Edinburgh, Scotland: Oliver and Boyd, 1970), 44. Scare quotes here are Parrinder's.

⁴⁰³ Patrick Parrinder, *Shadows of the Future: H. G. Wells, Science Fiction, and Prophecy* (New York, NY: Syracuse University Press, 1995), 22.

⁴⁰⁴ Jay Winter, "Introduction," *The War in the Air*, ed. Patrick Parrinder (New York, NY: Penguin Books, 2005), xiii.

gesture of empathy or—better—what recent critics have begun to theorize as shared vulnerability.”⁴⁰⁵

Efforts to draw such moralistic conclusions resort to a history of prophets as outspoken moral authorities, forth-tellers, as well as prognosticators of the future, foretellers. However, in the specific context of Wells scholarship, they miss the *The War in the Air*'s authorial and historical contexts: this is a story written by an Englishman, for an American readership, with a specific social vision and an international political agenda which he himself believed would be unachievable without the U.S. To read it in a moralizing way is to accept Wells-the-prophet's forth-telling moral authority at face value, which suggests we should accept his foretelling as well. Although Wells may have said things that made moral sense and also may have written visions of the future that turned out to be true, it does not necessarily follow that *therefore* he was a 'prophet,' that his stories were 'prophetic' or 'prescient,' or even that we should submit to his moral authority and work to realize his social and political vision for the future. To the extent that one concurs with my portrayal here of Wells as a literary and political manipulator, even awe at his future visions seems a naïve response. In describing Wells as a prophet, in treating his works as prescient, or in seeking some sort of moral guidance from his stories, we turn a blind eye to a great deal of his political thinking and influence, which, when duly considered, explain away a considerable amount of his 'foresight' and call into question his moral authority. Ostensibly because Wells was so fond of talking about "discovering the future," as though it is out there somewhere in time, beyond the horizon of now, few have considered the possibility that Wells's political influence *constructed* the future.

⁴⁰⁵ Sarah Cole, *Inventing Tomorrow: H. G. Wells and the Twentieth Century* (New York, NY: Columbia University Press, 2020), 8.

Wells the Politician

Starting, then, from this perspective—that Wells constructed the future—we must ask: what exactly did he want to see the world become? Wells most ardently desired a future World State that could ensure world peace. To do so, it would have to be equipped with modern machines and governed by the scientifically minded, objective authorities who could oversee humankind for its own good. As the Great War dawned, people became aware of how national allegiance compromised political, social, and cultural objectivity. So, in addition to self-styling as a scientific prophet, Wells began to posture as a cosmopolite. “I am a writer rather prejudiced against the idea of nationality; my habit of thought is cosmopolitan,” he wrote in *What is Coming? A European Forecast* (1916). “I hate and despise a shrewish suspicion of foreigners and foreign ways.”⁴⁰⁶ This is not mere posture; Wells seems to have believed it. Elsewhere that same year he intimated, “I am unblushingly international, cosmopolitan, and so forth in my feelings and habits of mind; nationalism, to be frank, bores me.”⁴⁰⁷ And yet his ‘cosmopolitanism’ was deeply motivated by concerns that cannot be construed as anything but nationalism, as his writing in the years leading up to 1916 demonstrates. During the first two decades of the twentieth century Wells began to express discontent with English society and doubts about the British Empire’s long-term viability. For this reason, he anticipated the futures of nations other than England—with an intense focus on the United States, owing to common language and culture—and built a political network that could carry these anticipations to concerned readers and leaders abroad.

⁴⁰⁶ Wells, *What is Coming?*, 254.

⁴⁰⁷ H. G. Wells, “Introduction,” *The Gods in the Battle*, by Paul Hyacinthe Loyson, trans. Lady Frazer (London, England: Hodder and Stoughton, 1916), xxiii.

In *The Future in America* (1906) one can detect the early stages of Wells's discontentment with England. "The American reader may very reasonably inquire at this point why an Englishman does not begin with the future of his own country," Wells noted. "The answer is that this particularly one has done so, and that in many ways he has found his intimacy and proximity a disadvantage. One knows too much of the things that seem to matter, and that ultimately don't, one is full of misleading individual instances intensely seen, one can't see the wood for the trees."⁴⁰⁸ Either this really was Wells's outlook in 1906, or he was being diplomatic. But even if it was his real outlook, "Of a Cross-Channel Passage" (1909) suggests that Wells did not see in Britain enough dedication to the mechanical innovation required to achieve what he had already seen in the U.S.. "As an undisguisedly patriotic Englishman I would like to see the lead in this intellectual synthesis of the nations, that *must* be achieved if wars are to cease, undertaken by Great Britain," he intimated a decade later. However, by then, he was "bound to confess that in Great Britain I see neither the imaginative courage of France nor the brisk enterprise of the Americans."⁴⁰⁹

Written in 1914, these words are the logical conclusion of ideas Wells had voiced in "Of a Cross-Channel Passage," his response to Louis Blériot's 1909 landing at Dover after becoming first to cross the English Channel in an aeroplane. As I have already noted in Chapter III, "Of a Cross-Channel Passage" exudes Wells's frustration with England's technological sluggishness, which he deployed with acerbic xenophobia toward his country's competitors, particularly France:

One meaning, I think, stands out plainly enough, unpalatable enough to our national pride. This thing [i.e., Blériot's aeroplane] from first to last was made abroad... And now our insularity is breached by the foreigner, who has got ahead with flying... But this

⁴⁰⁸ Wells, *The Future in America*, 22.

⁴⁰⁹ Wells, *What is Coming?*, 225-226.

event—this foreigner-invented, foreigner built, foreigner-steered thing, taking our silver streak as a bird soars across a rivulet—puts the case dramatically. We have fallen behind in the quality of our manhood. In the men of means and leisure in this island there was neither enterprise enough, imagination enough, knowledge nor skill enough to lead in this matter. I do not see how one can go into the history of this development and arrive at any other conclusion. The French and Americans can laugh at our aeroplanes, the Germans are ten years ahead of our poor navigables. We are displayed a soft rather backward people. Either we are a people essentially and incurably inferior or there is something wrong in our training, something benumbing in our atmosphere and circumstances. That is the first and gravest intimation in M. Blériot's feat.⁴¹⁰

In this passage, a year after the resonant ending note of *The War in the Air*—“somebody ought to have stopped something”—we see Wells’s recognition that Britain was not well positioned as a nation to stop anything, nor was it a culture whence the “someone” in question was likely to emerge. By the time Blériot flew across the Channel, Wells had realized that Britain’s best hope was to ally itself with a nation that *was* well positioned to stop something, and in his anticipations increasingly read as attempts to imagine Britain’s possible allies and the intercultural affinities on which such alliances might be built.

In January 1906 Wells told Henry James that he planned to visit the United States later that year. “Heaven knows when I shall return, and I am going to write loose large articles mingled with impressions of *The Future in America* (no less).”⁴¹¹ The fact that Wells already knew what he would write about calls into question the truly inductive, scientific nature of his ‘prophecies’ in *The Future in America*. The book also suffered from a tone of cultural superiority. “One cannot look ten years ahead in England without glancing across the Atlantic... Our future is extraordinarily bound up in America’s, and, in a sense, dependent upon it.”⁴¹² While at first glance this sounds egalitarian, in order to explain such dependence Wells

⁴¹⁰ H. G. Wells, “Of a Cross-Channel Passage,” *The Daily Mail* 4148 (27 July 1909): n.p.

⁴¹¹ Qtd. in J. R. Hammond, *An H. G. Wells Chronology* (New York, NY: St. Martin’s Press, Inc. 1999), 51.

⁴¹² Wells, *The Future in America*, 23.

distinguished between Britain's empire and its civilization. Although America no longer belonged to the British Empire politically, Wells admitted that "The common Englishman has an almost pathetic pride and sense of proprietorship in the States... America is his inheritance, his reserved accumulating investment. In that sense, indeed, America belongs to the whole western world, all Europe owns her promise, but to the Englishman the sense of participation is intense. 'We did it,' he will tell of the most American of achievements."⁴¹³ These words, written just three years after the Wrights flew at Kittyhawk, smack of presumption. Wells saw this presumption as a symptom of an English opinion that the United States had inherited an English civilization that "reaches out further into the future," and would continue after the political map of the world changed beyond recognition.⁴¹⁴ "Because of our common language, of our common traditions, Americans are a part of our community, are becoming, indeed, the larger part of our community of thought and feeling and outlook."⁴¹⁵

In fact, common language, shared history, and common political ideology were essential to Wells's literary efforts to influence the United States, for he used them in casting a future vision that grew out of America but resembled a futuristic British Empire and implied the subjugation of many non-Anglophone civilizations. When he visited in 1906, Wells had been particularly impressed by American transportation culture, which he saw in a teeming New York City:

Across the broad harbour plies an unfamiliar traffic of grotesque wide ferry-boats, black with people, glugged to the lips with vans and carts, each hooting and yelping its own distinctive note, and there is a wild hurrying up and down and to and fro of tugs and barges, piping and bellowing. A floating platform bearing a railway train gets athwart our course as we ascend, and evokes megatherial bellowings. Everything is moving at a

⁴¹³ Wells, *The Future in America*, 24.

⁴¹⁴ Wells, *The Future in America*, 23.

⁴¹⁵ Wells, *The Future in America*, 24.

great speed and whistling and howling it seems, and presently far ahead we make out our own pier, black with expectant people, and set up our own distinctive whoop, and with the help of half a dozen furiously noisy tugs are finally lugged and butted into dock. The tugs converse by yells and whistles, it is an affair of short-tempered mechanical monsters, amidst which one watches for one's opportunity to get ashore.⁴¹⁶

In this chaotic portrayal of New York's mechanicity Wells offered a glimpse of a World

Admiralty he imagined was necessary for connecting and governing a future World State:

I have already hinted at the possibility that the now exclusively British navy may some day be a world navy controlled by an Admiralty representing a group of allies, Australasia, Canada, Britain and, it may be, France and Russia and the United States. To those who knew how detached the British Admiralty is at the present time from the general methods of British political life, there will be nothing strange in this idea of its completer detachment.⁴¹⁷

Wells believed the United States and Britain faced the same future problem—"to resolve a confusion of purposes, traditions, habits, into a common ordered intention"⁴¹⁸—and assured his American readers that "It is not that we dream very much of political reunions of Anglo-Saxondom and the like."⁴¹⁹

But neither was Wells's dream of a World State altogether egalitarian; his vision of a World Admiralty continued thus:

There is nothing so very fantastic in this idea of a sort of World-Admiralty; it is not even completely novel. Such bodies as the Knights Templar transcended nationality in the Middle Ages. I do not see how some such synthetic control of the seas is to be avoided in the future. And now coming back to the "White Man's Burthen," is there not a possibility that such a board of marine and international control as the naval and international problems of the future may produce (or some closely parallel body with a stronger Latin element) would also be capable of dealing with these barbaric "Administered Territories"? A day may come when Tripoli, Nigeria, the French and the

⁴¹⁶ H. G. Wells, *The Future in America*, 53. Wells describes New York's machines in chaotic terms that evoke the myth of the New Eden highlighted by Leo Marx in *The Machine in the Garden*. There's an argument to be made that he believed the chaos of American machinery needed just a bit more British order to help it realize its full potential. See Leo Marx, *The Machine in the Garden: Technology and the Pastoral Ideal in America* (New York, NY: Oxford University Press, 1964).

⁴¹⁷ Wells, *What is Coming?*, 252.

⁴¹⁸ Wells, *The Future in America*, 354.

⁴¹⁹ Wells, *The Future in America*, 23.

Belgian Congo will be all under one supreme control. We may be laying the foundations of such a system today unawares.⁴²⁰

Clearly, Wells imagined this supreme control would belong, if not to the British, at least to a governance structure modeled on the British Empire, for it would control a navy like Britain's. Moreover, his reference to the White Man's Burden suggests that the World Admiralty would be located in a 'white' country, one that would use the navy to govern even some of the most ungovernable parts of the globe in Wells's time.

Considering his hairsplitting between empire and civilization and his vision for a World Admiralty, Wells's disavowal of "political reunions of Anglo-Saxondom and the like" rings hollow. Clearly, in 1906—two years before he published *The War in the Air*—Wells believed that the United States owed a kind of cultural allegiance to England, the country whose civilization, language, and customs pervaded American culture. Even if that cultural allegiance did not issue in immediate political reconciliation, by insisting on the Englishness of the United States' cultural heritage and by seeking to use that shared culture to influence American popular opinion and political leadership to select a specific version of the United States' future, Wells was working toward a World State that would *de facto* issue in "the political reunion of Anglo-Saxondom and the like," where "the like" included the rest of the world as well. And he had declared that if the United States accomplished such a World State, prevailing English sentiment would take satisfaction in the delusion that "*We* did it."

Nor was this imperialist thinking limited to Wells's stance toward the United States. In fact, many of his visions of the future World State were even more explicitly imperialistic. Consider just one example:

⁴²⁰ Wells, *What is Coming?*, 253.

It seems to be pretty generally believed today that our dense populations are in the opening phase of a process of diffusion and aeration. It seems pretty inevitable also that at least the mass of white population in the world will be forced some way up the scale of education and personal efficiency in the next two or three decades. It is not difficult to collect reasons for supposing—and such reasons have been collected—that in the near future, in a couple of hundred years, as one rash optimist has written, or in a thousand or so, humanity will be definitely and conscientiously organizing itself as a great world state—a great world state that will purge from itself much that is mean, much that is bestial, and much that makes for individual dullness and dreariness, grayness and wretchedness in the world of to-day.⁴²¹

Here we see the *sine qua non* of an education superior to the one Wells would later critique for allowing England's young men to focus more on cricket than on aviation: the ascension of "the white population" of the world, who would use their knowledge and power to form a World State that would purge the mean, bestial, grey, dull, dreary, and wretched from the world. The darker colors these terms connote contrast ominously with his visions of an explicitly white population ascending through education and of a time when African countries would "all be under one supreme control." From the twenty-first century, it is difficult *not* to read here a vision of global white supremacy enforced by well-designed machines. This chilling prospect is among what's usually occluded by the prophetic and cosmopolitan rhetoric used to describe Wells.

Wells was not satisfied merely to record his visions: during the years in which his World State vision took shape he specifically targeted world leaders with his writing, such that, over time, many of his anticipations came true. In this sense, he constructed the future rather than prophesying it. Wells's political network began when his publisher sent a copy of *Anticipations* to Winston Churchill, then a new Member of Parliament with the Conservative Party.⁴²² Their

⁴²¹ Wells, *Discovery of the Future*, 51-52.

⁴²² David C. Smith, *The Correspondence of H. G. Wells, Volume 1: 1880-1903* (London, England: Pickering & Chatto, 1998), 457.

correspondence indicates that Churchill arranged to meet Wells in March of 1902 to discuss the book.⁴²³

During his 1906 journey to the United States, Wells visited Washington, D.C., Boston, New York, Niagara, and Chicago. It was after this visit that the United States began to figure prominently into Wells's anticipatory writing. He attributed to the U.S. "the mind of a modern state,"⁴²⁴ but in response to seeing the Library of Congress he asked his guide, "With all this, why doesn't the place *think*?"⁴²⁵ a presumptuous question that bespeaks his belief that the United States needed someone like him to envision its future. While in the U.S., Wells met President Theodore Roosevelt, whom he saw as a kindred spirit,⁴²⁶ someone who seemed "to be echoing with all the thought of the time, he has receptivity to the pitch of genius. And he does not merely receive, he digests and reconstructs; he thinks."⁴²⁷ Not coincidentally, Roosevelt had read *The Time Machine* and made it a matter of conversation during Wells's visit. "Suppose, after all' [Roosevelt] said slowly, 'that should prove to be right, and it all ends in your butterflies and Morlocks. *That doesn't matter now*. The effort's real. It's worth going on with. It's worth it. It's worth it—even then."⁴²⁸ In Roosevelt Wells saw "the seeking mind of America displayed...

⁴²³ Smith, *Correspondence of H. G. Wells, Vol. 1*, 458. I believe there is a case to be made that Wells became a cover operative of the British government at this time. How else did Wells gain a private appointment with Theodore Roosevelt at the White House when he visited the United States four years later? Nevertheless, this line of reason lies afield of my argument here.

⁴²⁴ Wells, *The Future in America*, 285.

⁴²⁵ Wells, *The Future in America*, 331.

⁴²⁶ Wells must have been taken aback in 1910 when Roosevelt, having retired from politics, made public comments during a European tour to the effect that Wells's advocacy of free love amounted to advocating the abolition of the family unit. Smith notes that Wells lashed back using Roosevelt's words against him, calling him "the thick head behind the 'thick stick.'" See Smith, *Volume 2*, 285.

⁴²⁷ H. G. Wells, *The Future in America* (London, England: Chapman & Hall Ltd., 1906), 343.

⁴²⁸ *Ibid.*, 349-350.

His mind is active with projects of solution for the teeming problems around him... he is, to a singular completeness, the mind and will of contemporary America.”⁴²⁹

As Germany became more militant in the years following and Wells began to place more hope in the United States’ potential to usher in a World State, more of his writing prompted American readers and leaders to action. In November 1917, during the Great War, Wells wrote to Woodrow Wilson urging him to require each nation embroiled in the conflict to issue a clear statement of war aims; this was a tenet of Wilson’s Fourteen Points, which were delivered in January of 1918.⁴³⁰ Although it is unclear whether Wilson was influenced by Wells, in recounting this correspondence in *Experiment in Autobiography* Wells included a copy of the letter along with the account, inviting the reader to decide whether he *had* actually influenced Wilson’s approach to postwar reconstruction and the formation of a League of Nations. Even if Wilson was not actually influenced by Wells, Wells’s belief that he might have been fed his own self-image as cosmopolitan prophet and his conviction that his writing, whether fiction, essays, propaganda, or correspondence, was shaping the modern future as he invested effort in getting his ideas read by the leaders of modern nations.

Most presumptuous was Wells’s 1934 letter to Franklin D. Roosevelt, in which he invited himself to the White House:

I am profoundly interested in the world situation and I want very much to have half an hour’s conversation with you. I am coming to America early in May on the chance of being able to have that brief talk. If I could talk to you and to Mrs. Roosevelt all sorts of things that are vague in my mind will become definite. I am more and more persuaded that you are in a key position in the world’s affairs and extraordinary right-minded and right-spirited... I’ve talked to Roosevelt I [an English distortion of the American

⁴²⁹ Wells, *The Future in America*, 343.

⁴³⁰ Wells, *Experiment in Autobiography*, 602-611.

president as a kind of regent], Harding and Hoover at Washington and I shall be extremely grateful if you can give me an appointment.⁴³¹

When he wrote about this visit in *The New America: The New World* (1935), Wells's impressions of FDR were similar to his impressions of Theodore Roosevelt. However, one point in Wells's reflection on their meeting is telling: "the role of the democratic President is to be a sort of sounding board by means of which general directive ideas can be got over from the people who know and think hard, to the mass of the people and to legislative and administrative realization."⁴³² Here Wells was referring to FDR's Brain Trust, but he chided the Executive Branch's apparent inaction with the argument that if the President's role is to direct Congress and the people to adhere to the knowledge of experts, and if he and the experts will not draw conclusions and act decisively, then thinking for and directing the people must fall to the publicist.⁴³³ Obviously such a conclusion favored men like Wells, who by that time was a household name in the U.S., thanks partly to Orson Welles's radio adaptation of *The War of the Worlds*.

For all of Wells's concern with the United States, his anticipations were not limited thereto. His book *An Englishman Looks at the World* (1914) expressed apprehension that the United States might become more closely allied with some nation other than England.

Historically and politically the citizen of the United States must be drawn most closely to France. France is the one other successful modern republic; she was the instigator and friend of American liberation. With Great Britain the tie of language, the tradition of personal freedom, and the strain in the blood, are powerful links. But both France and Britain are old countries, thickly populated, with a great and ancient finish and completeness, full of implicit relationship; America is by comparison crude, uninformed, explicit, a new country, still turning fresh soil, still turning over but half-explored natural resources. The United States constitute a modern country, a country on an unprecedented

⁴³¹ Smith, *Volume 3*, 524.

⁴³² H. G. Wells, *The New America: The New World* (London, England: The Cresset Press, 1935), 52.

⁴³³ *Ibid.*, 53-54.

scale, being organised from the very beginning on modern lines. There is only one other such country upon the planet, and that curiously enough is parallel in climate, size, and position: Russia in Asia.⁴³⁴

This mattered to Wells because he observed “a tendency in all the British colonies to read American books and periodicals rather than British, if for no other reason than because their common life, life in a newish and very democratic land, is much more American than British in character.”⁴³⁵ As a former British colony reputed for having won its independence, he believed in the United States’ influence on other British colonies’ political thinking, in which he saw a path to a World State.

Wells described his international political vision for the future as “the United States of the World, a union of States whose state boundaries are determined by what I have defined as the natural map of mankind.”⁴³⁶ He believed that world peace is the only peace, and “that is only to be kept by the whole world resisting and suppressing aggression wherever it arises”⁴³⁷ (even if that meant purging the world’s ‘darkness’), and he insisted on the United States’ cultural and political leadership in this vision because he believed that “The pattern of the United States, in which the procedure is first the annexation of ‘territories’ and then their elevation to the rank of ‘States,’ must, with of course far more difficulty and complication, should be the pattern for the ‘empires’ of today.”⁴³⁸

⁴³⁴ Wells, *What is Coming?*, 220.

⁴³⁵ Wells, *What is Coming?*, 244.

⁴³⁶ Wells, *What is Coming?*, 238.

⁴³⁷ Wells, *What is Coming?*, 217.

⁴³⁸ Wells, *What is Coming?*, 261-262.

Wells likely considered the possibility of an Amero-Russian alliance in *An Englishman Looks at the World*⁴³⁹ because in 1914, the year it was published, he and Maurice Baring traveled to Russia together. A visit to the Duma during that journey began a series of interactions with Russian leaders that would eventually include Wells's 1945 interview with Stalin. From Wells's correspondence with Maxim Gorky, the socialist realist and Nobel Prize nominee, we get a sense of his desire to witness the rise of a World State, and his willingness to contribute to it. Anthony West, Wells's and Rebecca West's son, recounts his father's excited visit to his mother's house when news of Tsar Nicholas II's abdication reached England: "He had been staying with my mother... when the news that the last of the czars had been forced to abdicate reached London in March 1917. His immediate reaction to this event had been to hurry to her side. He had burst in on her with the excited words 'It's begun...' He saw it as the beginning of a universal revolt."⁴⁴⁰ According to West, after Alexander Kerensky took power in July 1917, Wells had written "joyfully to Gorky at that time to wish him and his friends success in their 'struggle to liberate mankind, the German people included, from the net of aggressive monarchy, and to establish international good will on a basis of international justice and respect.'"⁴⁴¹

The Wells-Gorky correspondence would have a profound effect on twentieth-century international politics, though hardly the effect Wells intended. It bears mentioning that Wells was inspired by and influenced the scientists whose work resulted in the nuclear threat that defined the Cold War. In 1913 he published *The World Set Free*, which he dedicated to Frederick Soddy, the 1921 Nobel Prizewinner whose *A Study of the Radio Active Elements*

⁴³⁹ Wells, *What is Coming?*, 237.

⁴⁴⁰ Anthony West, 71.

⁴⁴¹ Anthony West, 72.

(1912-1914) outlined the theory behind a nuclear explosion. In a 1913 letter to A. T. Simmons, Wells intimated:

I've suddenly broken out into one of the good old scientific romances again. And I suddenly want to know quite the latest about atomic theory and sources of energy. I've read and mastered Soddy's very good little book and I want more. My idea is taken from Soddy. Men are supposed to find out how to set up some atomic degeneration in the heavy elements just as they found out long ago how to set up burning in coal. Hence, limitless energy.⁴⁴²

Wagar has noted that *The World Set Free* inspired American nuclear researcher Leo Szilard and rocket engineer Robert Goddard, and their work accounts for the development of the American nuclear missile program. Szilard enclosed pages from Wells's book in a letter to Sir Hugo Hirst, founder of the British General Electric Company, in an attempt to interest Hirst in the futuristic vision of nuclear power, and he is famous for having convinced Einstein to sign a petition for a nuclear program submitted to FDR in 1939. Goddard developed several types of rockets, including the bazooka, and according to Wagar, "All modern rocket artillery, jet-propelled aircraft, and of course ballistic missiles, owe much to Goddard's studies."⁴⁴³

Not only did Wells influence nuclear development through fiction, he also personally transmitted Soddy's research to Russia. Smith has explained that, in the wake of the Russian Revolution, "Wells was astonished that Russian scientists had been deprived of contact with western science since the First World War. When he returned to England he formed a committee along with Ray Lankester and Richard Gregory, to send needed modern scientific texts and papers to Gorky who then distributed them to the appropriate libraries."⁴⁴⁴ We know that Gorky received scientific texts from Wells, including Soddy's research, because he wrote to Wells

⁴⁴² Smith, *Volume 2*, 343.

⁴⁴³ Wagar, "H. G. Wells and the Scientific Imagination," 7.

⁴⁴⁴ Smith, *Volume 3*, 56.

informing him that “Some [of the] books [Wells had sent] are being translated into Russian—first of all the articles and speeches of Soddy.”⁴⁴⁵ What is perhaps most interesting is that Wells sent Soddy’s research to Gorky with full realization that Soddy’s work could be used to develop a bomb like the one he had described in *The World Set Free*, which he had dedicated to Soddy. Wells’s comments to Simmons corroborate his knowledge of Soddy’s research’s deadly applications. Perhaps because he was a socialist, Wells didn’t see Russia as a political threat. Perhaps even at that early date he assumed that socialism was where Britain and the U.S. were both headed politically and economically, for he had certainly reached that conclusion by the time he published *New America, New World* in 1935.

Conclusion

Wells’s transmission of Soddy’s research to Russia is a case study in the sort of sociopolitical impact Wells believed he could have, that he desired to have, and that he wrote with the intention of having: this is what all the posturing as a cosmopolitan prophet was about. He may not have intended to inspire the development of a nuclear warhead, but he certainly intended to inspire the development of the modern world, including futuristic biomorphic machines that could be weaponized or, at the very least, that could connect the nether reaches of the globe and make the entire planet governable by a political center. We may admire this as a vision for some grand World State but, to adapt Shakespeare’s words, “An empire by any other name would wield no less power.”

⁴⁴⁵ Smith, *Volume 3*, 56.

Epilogue: Tracing (or Mapping) the Mechanimal Rising

The archival/archaeological task, as I understand it, consists of developing a chain of associations that seem, retrospectively, to have converged already in literary work. The analytical task consists in representing that convergence as an image that freshly elucidates the signifying structures and material changes of everyday life—the task, in other words, of producing the history that lingers within neglected images, institutions, and objects. Much of the point amounts to understanding how literature helps us to understand the unconscious as material history and history as the unconscious, as the necessarily repressed that can be rendered visible in sites of contradiction or incomplete elision. Leaving such sites unexplored amounts to recirculating the dominant cultural memory.

Bill Brown, *The Material Unconscious*

Here I have presented the rise of the mechanimal as a literary history, but one informed by artistic craft, scientific research, material culture, political agendas, authorial portrayal, and consumer demand for transportation and stories about it, among others. Formally, that history is rhizomatic. Functionally, the mechanimal is something of an assemblage. Ultimately, I have been in search a line of thinking that can prevent the mechanimal from becoming, in Timothy Morton's sense of the term, a "hyperobject."

Overall, the shape of this project, with its emphasis on the scientific romance, may leave the reader with the impression that I see the mechanimal's emergence as primarily the result of literary imagination; as such and in Deleuze's and Guattari's terms, the reader might come away with a sense that the mechanimal's development has been arborescent, that mechanimals emerged ideationally from the central trunk of the scientific romance, or, materially, from the ship. One might charge that I have "started from an over-coding structure or supporting axis," that I have "articulated and established a hierarchy of tracings," which are like the leaves of a Linnaean family tree of mechanimal bodies. In fact, I have gone so far in the introduction as to use the verb "trace"—not the verb "map"—to describe what I am doing in this dissertation, when

Deleuze and Guattari have explicitly charged: “Make maps, not tracings.”⁴⁴⁶ I was well aware of this injunction when I began writing, but then the question loomed large (and I live with it still): can there be a map that is not imperialistic? If not, then compared to the map’s heavy-handed declarativity a trace is gentle, suggestive, a puzzling-over of, in this case, archival remnants in an effort to understand the technological wonders and terrors that have arisen this century.

If “to understand” is also “to stand under,” to, as it were, “get to the bottom of,” I should note that there may be no bottom of the mechanimal to get to, other than the ancient myth of the War at Troy, or the primordial rivalry between Cain and Abel. Nevertheless, and whether we understand it or not, we now stand under the mechanimal: the mechanimal is rising, has risen, and we walk beneath it as it flies, before it as it crawls and runs, and beyond it as it swims. The chapters preceding demonstrate that, even when they do not have an insectine appearance at all, mechanimals are nevertheless ant-like inasmuch as “We never get rid of ants, because they form an animal rhizome that never ceases to reconstitute itself, even when almost completely destroyed.”⁴⁴⁷

This should suggest that, arborescent though it seems, what I have offered here is more rhizomatic than it initially appeared. And why not, for after all, this is “The wisdom of plants: even when they have roots, there is always an outside where they form rhizomes with something—the wind, an animal, man (and also a perspective in which animals themselves, man, etc., form rhizomes).”⁴⁴⁸ So this arborescent project, beginning with the scientific romance and the ship, is really only a node within a much larger rhizome that also includes the Trojan Horse,

⁴⁴⁶ Deleuze and Guattari, 25.

⁴⁴⁷ Gilles Deleuze and Felix Guattari, “Rhizome,” *On the Line*, trans. John Johnston (New York, NY: Semiotext(e), Inc., 1983), 18

⁴⁴⁸ Deleuze and Guattari, 22.

Homer's and Virgil's equations of the horse with the ship, Renaissance automata, *Frankenstein*, Muybridge's photos, Legos, the animatronics of the world's museums, even the then-revolutionary CGI dinosaurs of Spielberg's *Jurassic Park*.

Among other things, this dissertation is an objection to monolithic power. If I have “traced” instead of “mapping,” it is because I object to the will-to-power behind maps (though I find them fantastically beautiful), as Chapter III suggests. If I have constructed as arborescent a segment of a larger rhizome, it is because so much past scholarship on the authors I have treated here—science fiction scholarship—has been imperialistically arborescent, rooted in Gernsback and in definitions of “science fiction.” Part of my strategy has been to point out that the branch of science-influenced twentieth-century fiction grew out of what might be construed as a trunk of romance. But that trunk is really a node of a rhizomatic assemblage of human power grabs, literary, material, and otherwise. The scientific romance was intensified by scientists' increasing insistence on the value of their once-armchair pursuits, which, in the nineteenth century, earned them access to the halls of Parliamentary (and Congressional) power. It was also intensified by such powers, which have used romance—including its branch, science fiction—as a tool for aweing people into buying into the vision it purveys, or for terrifying them into silence while governments (and anti-governments) fund a tech development cycle that spins madly on. Whereas Rieder has sought to decolonize science fiction (my use of the term, not his) to make it more accessible to writers and readers from beyond the modernity-tinged regions of the world, I have pointed out science fiction's roots in imperial thinking and suggested its role in realizing the machinery of power that yester-century's autocrats only dreamed of.

Some may object that this is too self-congratulatory, especially given my regular use of the construct “the mechanimal,” with the definite article, which elsewhere, as in “the animal,”

effaces the bodies elided under such a generalized descriptor. As I mentioned in the introduction, I have “life-ist” motives for this: so-called “animals” are qualitatively different than mechanimals; we found them along our evolutionary-historical way, we did not make them, and they do not necessarily serve our purposes; often they thwart our purposes. On the one hand, then, to elide all living, animate nonhumans under the term “animals” is to do a kind of rhetorical violence to their identities by eliding their differences: dogs are no longer wolves, and they have never been octopi. Understanding such differences is crucial to humans’ relationships with each of these species.

On the other hand, to elide all biorobots that resemble nonhumans under the term “mechanimals” is to aggregate and reveal the systemicity of so many instances of human mistreatment of ‘animals.’ As Shukin has pointed out, “Entwined in the covert figure of the animal automaton... is a figure of mimesis; the animal nature of mimesis and the mimetic nature of animals remain pivotal assumptions underpinning modern capitalism’s social and economic [and military] projects.”⁴⁴⁹ Foregrounding the extent to which human technological projects assume that the forms of nonhuman animals are more or less raw material for human design efforts is an important premise of the argument that so much human experimentation, dissection, and vivisection have never been solely about knowledge of nonhuman animals, they have always been human practices with human ends in sight, parts of a larger social assemblage in which those ends were only means to larger *human* political aims. Humans have and still are systematically attempting to replicate nonhuman life, which entails violence to individual nonhuman bodies, either now or in the past. This is why the Lewisian refrain—“what we call

⁴⁴⁹ Nicole Shukin, *Animal Capital: Rendering Life in Biopolitical Times* (Minneapolis, MN: University of Minnesota Press, 2008), 89.

Man's power over Nature turns out to be a power exercised by some men over other men with Nature as its instrument"⁴⁵⁰—appears so often in this dissertation: in some sense, the history of modernity is a history of the most intense, systematic human attempts to control other humans by mastering nature. And after a century of such attempts, they have become systemic, quotidian, the way things work.

The mechanical itself is an assemblage that includes not only literature, zoological anatomy and physiology, design thinking, mechanical precision, and industrial production, but also imperialist nationalism. (And there are still more parts to this assemblage that I have not mentioned here.) In the introduction to the zoocriticism section of their excellent collection, *Postcolonial Ecocriticism*, Graham Huggan and Helen Tiffin identify four ways that “dominant European discourses have expressed that dominance by constructing others—both people and [nonhuman] animals—as animal.” First, some people groups have dominated others by treating them “like animals,” enslaving them or exterminating them. Second, those in power sometimes pit human groups against nonhuman species in zero-sum survival scenarios predicated on scarce space or resources. Third, some human groups are marginalized or incriminated for ‘mistreating’ species that are differently valued by a surrounding majority culture. The last is a domineering neoliberal red herring: “why worry about animals when children are starving, or when other people are still being killed, raped, and abused?”⁴⁵¹

⁴⁵⁰ C. S. Lewis, *The Abolition of Man* (San Francisco, CA: HarperSanFrancisco, 2001), 55. Lewis understood that, materially, nonhuman species were being inexorably caught up in the modern machinery of human militaries and economies, though his own representations of animals were problematic. See Clare Echterling, “Postcolonial Ecocriticism, Classic Children’s Literature, and the Imperial-Environmental Imagination in *The Chronicles of Narnia*,” *The Journal of the Midwest Modern Language Association* 49:1 (Spring 2016): 93-117.

⁴⁵¹ Graham Huggan and Helen Tiffin, “Part II Introduction,” *Postcolonial Ecocriticism: Literature, Animals, Environment* (London, England: Routledge, 2010), 134-137.

This dissertation adds to this list at least two more expressions of international dominance. Fifth, the mechanimal terrors I have discussed in Chapters III and IV are instances of one people group's subjection of a nonhuman animal that inspires terror in another people group. Subjection of fearsome animals in order to display racial, social, national, martial, or technological dominance treats the animal as a placeholder for the rival society and establishes oneself and one's people as more evolved than a rival people group that is, for whatever reason, reticent or unable to subdue the fearsome animal. In a post-Darwinian age, this fifth category helpfully focuses our attention on the implicit power statement made when colonizing humans violate animals that inspire fear in human others: "We have mastered what you still fear." Such subjection bestializes the subdued animal as well as the members of the rival society by implicitly declaring the conquering human's or humans' superiority to both the animal and those who feared or were unable to subdue it. This is the spirit of the epic at least since Homer, and *Beowulf* demonstrates the extent to which it is native to Anglophone literature as well.

A sixth misuse logically follows (there is always more to follow) from the subjection of fearsome animals: human appropriation of fearsome animality. The reuse of animal forms as patterns for technological progress, for the development of machines which were then—and continue to be—used by some humans to gain power over others, is the *sine qua non* of the mechanimal vision. The nineteenth-century reemergence of the romance form, which Ker sees as a flowering of the epic and which aestheticizes the animal body and its human master, legitimated anatomists' attempts to master animals and also expressed the importance of such attempts in terms of the values of the imperial center. Since twenty-first century science has expanded to include STEM, roboticists and engineers are now included in the romantic heroism of nineteenth-century scientists. The result is that STEM is at least as entwined with a global

vision cast by the geopolitical centers of North America and Europe as science was in the nineteenth century; in many ways, STEM is an even more effective political tool than science was, since it includes not only pure inquiry but also the development of applications of research. Moreover, the heroism of STEM researchers promotes their work not so much on its merits as on its ‘wow-factor’ as seen in abbreviated formats such as TEDTalks.

While Shukin has focused on the fundamental assumptions driving the mimetic work that perpetuates the use of animal form as a resource, and while Huggan and Tiffin have exposed some of the dire geopolitical implications of those assumptions, here I have sought to offer a sense of the age of mimesis’s entanglement in imperialism. If this dissertation seems reactionary, if it seems to be drawing attention to quotidian objects and order than many see as no real cause for alarm, that is only because of the longevity of the assumption that animal form is a tool available for human use, particularly in ordering society. When the longevity and pervasiveness of this assumption are considered, it becomes apparent that nonhuman animality is a hyperobject, in Timothy Morton’s sense of the term. As Morton defines them, “Because they so massively outscale us, hyperobjects [magnify] weirdness of things for our inspection: things are themselves, but we can’t point to them directly.”⁴⁵² Morton sees the steam engine as a harbinger of the Anthropocene, which has left myriad material marks on the globe, including “a thin layer of radioactive materials, deposited since 1945”⁴⁵³; even more than the ubiquitous machinery made possible by because connected to the universal machine of the steam engine, this radioactive layer is a hyperobject.

⁴⁵² Timothy Morton, *Hyperobjects; Philosophy and Ecology After the End of the World* (Minneapolis, MN: University of Minnesota Press, 2013), 12.

⁴⁵³ Morton, 4.

In a similar way, biorobots powered by human-made artificial intelligence have the potential to irrevocably alter nonhuman animality, the way that human manufacturing has already altered nonhumans' habitats and, we fear, their biostructures and genetic material as well. As human-made machines become more autonomous and more able to pass as biological, their biomimetic form may camouflage their actions and enterprises from human eyes; but it will draw attention from nonhumans as well. What impact will machines that humans have taught to think have on nonhuman animals? And what instincts, habits, movements, dispositions, and behaviors will human-made AI acquire from mingling with nonhuman animals? Ultimately, these questions point to mechanimal vision's potential to affect not only human life, including economics and politics, but nonhuman life as well.

Conclusion: The Rise of the Mechanimal

In closing, let me return to the rubric mentioned above, which, I have suggested, is essential for "understanding" the mechanimal as a result of the assumptions Shukin has identified, of a modern subconscious, albeit one shaped even by premodern European history and literature, that sees animal form as a raw material.

The mechanimal is before us upon the land, beyond us in the water, and above us in the air. In many ways, the mechanimal before us has become quotidian. It takes the forms of our commuter vehicles (our Cougars, Mustangs, and Rams), our earth-movers (Caterpillars and Bobcats), and our war machines. Only recently has it more overtly assumed animal shape, as in the biorobots designed by Boston Dynamics, such as the SpotMini. Beyond us, the mechanimal in the water still evokes the sublimity of Melville or Verne, but this is perhaps a function of the fact that Earth's oceans remain one of the last frontiers on the planet. After all, Hollywood's periodic reminders that the nuclear imbroglio humankind has feared since the World Wars is

likeliest to be started by a Nemo-type who misunderstands his admiral's orders or who goes rogue are becoming commonplace. Nevertheless, even though those of us who take cruises for recreation know that the leviathans of modern navies soar below us, if one suddenly rose to the surface we might discover it is still more sublime than expected.

In a different way, this dissertation performs such a rising: it brings up the mechanimal, a subject which, until the recent emergence of biorobots, lay uncomfortably beneath the discourses of, in our daily lives, vehicular onomastics and science fiction literature and film, and, in modern history, wartime propaganda and the epilogue-dreaming of nineteenth-century anatomists, among others. It has been sublimated like our abattoirs have been sublimated; perhaps it has been sublimated along with our abattoirs, or *because* our abattoirs have been sublimated.

Whatever the case, bringing it up seems risky because, whatever else it does, it reveals a postanimalism that arguably predated posthumanism. Here again is the logic of science: try it on a 'test subject' first. The successful appropriation and repurposing of nonhuman animal form as vehicles and robots has promised us similar successes as we appropriate and repurpose human form. Boston Dynamics's SpotMini constitutes a transcaninism that foretells of transhumanism. And if we ethically object to treating nonhumans this way, what does such objection mean for the vision that has been cast for tomorrow's humanity? We must ask ourselves: have we really bought so readily into the wonders of some futurists' visions of tomorrow?

Alternatively, to the extent that the mechanimal is a terror, perhaps it has not been brought up because it is a flight risk. In *Frankenstein*, Mary Shelley's archetypal, constructed monster was ever a flight risk. As the history of the scientific romance demonstrates, the risk of bringing up the mechanimal is that it will eventually take to flight. By writing about it—by raising the subject, by bringing it up—Butler, Verne, Greer, and Wells heightened the risk that

the mechanical, in the form of whatever species, would, like the contents of Pandora's box, irreversibly take to flight. "There is a rupture in the rhizome each time the segmentary lines explode into a line of flight," Deleuze and Guattari note. Even so, they remind us—and perhaps this is the hope that remains—"the line of flight is part of the rhizome."⁴⁵⁴ Since I have only traced here, and a map is apparently what we need, there is more work to be done.

⁴⁵⁴ Deleuze and Guattari, 18.

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