HOPE AND ANXIETY ON THE ENDLESS FRONTIER:
SCIENTISTS, STATE POLICY AND THE POPULAR IMAGINATION SINCE 1945

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Abstract

The era following the conclusion of World War II witnessed numerous discursive struggles over the public benefits of science and technology. Scientific advancement has been imaginatively configured in a countless array of relationships to social progress, from ticking time bomb to benevolent savior. These contested meanings can only be understood relative to the historic governmental, material, and social forces that shaped power relations between scientists, policy makers, and public constituencies along axes of capital, race, nationality, gender, and knowledge. The United States federal government took on a radical new relation to the production of scientific knowledge, establishing large, permanent bureaucracies to fund and oversee research. The nascent research institutions, including the National Science Foundation, National Institutes of Health, Advanced Research Projects Agency, Atomic Energy Commission, and National Aeronautics and Space Administration, quickly became the single largest source of funds across virtually every scientific discipline, cementing a link between science and the state in the popular imagination.

Cultural representations of scientists, both real and fictive, became critical discursive sites for negotiating the meanings of this nascent political formation. This dissertation argues that "the scientist" often stands in as the mitigating force between federal policy or institutions and the public interest, functioning symbolically as the embodiment of contested meanings of scientific advancement. This mythology was crafted across a disparate array of popular cultural forms, middlebrow news media, and policy debates at several key historical moments through the latter half of the twentieth century. The biographies and public personae of scientists like Robert Oppenheimer and Wernher von Braun, as well as technological entrepreneurs like Bill Gates and Steve
Jobs, worked in concert with popular films (*The Day the Earth Stood Still*, *2001: A Space Odyssey*, *Revenge of the Nerds*) and television series (*Tomorrowland*, *CSI*) to forge the central features of the mythologized figure of the scientist. The personal qualities and desires of scientists as imagined through these arenas were not only markers of American attitudes towards science and technology, but active forces in the construction of cultural meanings for science, the state, and the relationship between the two.
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Introduction

Jonathan Lethem's 1997 novel, *As She Climbed Across the Table*, describes a love triangle between a man, a woman, and a hole in the universe. The story is set at a fictional university where the narrator and protagonist, Philip Engstrand, is an interdisciplinary anthropologist in love with his colleague Alice Coombs, a particle physicist. The head of the physics department, Professor Soft, is attempting to recreate the conditions of the Big Bang when he accidentally produces a phenomenon, affectionately dubbed "Lack," that can only be detected by the absence of certain particles which should pass through the laboratory. Coombs is the first to discover that Lack bears a preference for some kinds of particles over others, and from this extrapolates that Lack is an intelligent entity. She becomes obsessive over Lack, moves out of the apartment she shares with Engstrand to stay in the laboratory, and proclaims her love for the phenomenon, going as far as attempting to climb into the void to see if it will absorb her as well. As a literary device, Lack is a metaphor for the absences and unfulfilled desires that permeate the novel: Soft's quest for a Nobel Prize, Coombs' wish to understand Lack, and especially Engstrand's longing for Coombs to return his affections.

However, there is a key turning point in the story when Engstrand, driven by his jealousy of Coomb's attention to Lack, speaks at a press conference called by the physics department. Admonishing both the audience and the gathered scientists, Engstrand, who as an interdisciplinary scholar believes he is speaking for the university community at large, decries the solipsism of the physics faculty:

The physicist tends to see his subject as the indivisible core around which metaphor orbits. Physics is the universal tongue, the language the aliens will
speak when they appear … I have to question the assumption that Lack's preference is for particles, in and of themselves. Why do we assume that our visitor is a physicist, that he finds particles interesting? So he prefers H's to M's. What about summer and winter? Which does he like best? Black and white, or color? Poetry or prose? Bebop or swing? I think we're leading the witness. Our questions are dictating his answers. We want physics, so we get physics.¹

Following his charge, the project shifts to include competing teams, comprised of both physicists and scholars from other fields, working to understand Lack. They begin by testing what other things Lack will absorb: paperclips, light bulbs, duck eggs, photographs, a volume of Plutarch. Lack is seemingly erratic in its selections, but also consistent: once it has refused an object, it will never accept it in a subsequent test. Some of the participants begin treating Lack as an oracle, sending handwritten questions through the void with the notion that if Lack accepts them, it indicates an affirmative answer. While Lack's preferences are initially mysterious, it is eventually revealed that they are parallel to Alice's own desires – i.e. what she likes, Lack likes – thus retroactively confirming Engstrand's accusation that the outcome of the project was determined by the interests of the physicists who created it. In the concluding pages of the novel, Engstrand enters Lack in an effort to see if Alice still desires him, and the narrative voice shifts, indicating that Lack and Engstrand have merged into a single consciousness. The final, titular image comes as the new Engstrand-Lack sees Alice climbing across the laboratory table toward him, signaling the reunion of the Interdean with his physicist.

What is unusual about Lethem's text is not, of course, the use of fictive scientific concepts or language to explore social phenomena – that is an aesthetic technique that dates back, in English literature, at least hundreds of years. Rather, what is intriguing about *As She Climbed Across the Table* is the extent to which it explicitly interrogates the relationship between scientific institutions and the broader public within the diegetic space of the story. Within the novel, the quest to define Lack is not simply a question of uncovering a latent epistemic Truth, but an active struggle about the social meaning of scientific advancement. The aptly named Lack is defined entirely by desire – both its own apparent desire for particular objects and particles, as well as the desires of the competing factions to lay claim, by way of definition, to Lack. Within the fictive space of the novel, Lack's creation may certainly represent a better understanding of the nature of the universe, or grants or prizes for the scientists involved, but Engstrand's polemic and the projects that result asks readers to consider the relevance to a wider configuration of human endeavors, from Plutarch and bebop to love and family. Engstrand asks us not what Lack *is*, as a physical phenomenon, but what it *means*.

It is perhaps unsurprising that Lethem's novel was published at a moment of marked transformation in the political significance of American scientific research. Two of the central pillars – national defense and Cold War supremacy – undergirding the military-industrial-scientific state were of diminishing saliency following the dissolution of the USSR at the beginning of the decade. This shifting political formation had ramifications across a wide array of scientific policies and institutions, from federal funding commitments to alliances between research universities and the armed forces. Just a year prior to the release of *As She Climbed Across the Table*, Tom Weimer, the staff director
for the House Basic Research Subcommittee, noted that "While certainly not the end of national security issues requiring substantial science and technology involvement, the end of the Cold War resulted in a weaker engine for the freight train that has pulled federal support for science and technology, including substantial civilian research and development activities …. From my personal observation, I have seen no replacement emerging with the equivalent political support that the national security engine once enjoyed in engendering support." Out of political necessity, research institutions dependent upon federal support found themselves struggling to rearticulate their relevance to social welfare and the public good. But although the conclusion of the Cold War required some soul searching and renewed public relations efforts from these institutions, it was not the first time they were facing these questions. Indeed, since the emergence of support for large-scale, permanent civilian scientific research after World War II, policy makers, institutional staff, and advocates for public research spending have attempted to establish the connection between scientific progress and public interest.

Similarly, Lethem's novel was hardly the first popular text to interrogate the relationship between science policy and the public good. While it is uncommon for American popular culture to engage the question quite as explicitly as *As She Climbed Across the Table*, the late twentieth and early twenty-first centuries have nonetheless been replete with discursive struggles over the public benefits of science and technology. Scientific advancement has been imaginatively configured in a countless array of relationships to social progress, from inevitable savior to ticking time bomb. And each new technological breakthrough or scientific discovery, from atomic theory and robotics

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to digital computing and mapping the human genome, seems to raise these concerns anew, asking whether scientific progress continues for the sake of public interest or despite it. The debate has spilled across a wide range of cultural forms, from films, comic books and television serials to the nightly news and editorials in middlebrow magazines. Although direct invocations of policy are rare in popular culture, the material and political circumstances of scientific research consistently permeate these texts.

An examination of the relationship between these two forces – the evolution of federal science policy and popular imaginings of science – lies at the heart of the present inquiry. My principal contention here is that representations of scientists are critical discursive sites in negotiating this debate. Using Roland Barthes' concept of mythology, I suggest that "the scientist," whether a real historical actor or a fictive one, often stands in metonymically as the mitigating force between federal scientific policy or institutions and the public interest. At a discursive level, scientists' personae become synonymous with the purposes of scientific research: that is, much as Lack as a technological artifact and physical phenomenon is quite literally constituted by Alice Coombs' desires, scientists frequently function symbolically as embodiments of the contested meanings of scientific knowledge or technological development for daily life.

I further argue that these images are best understood in the context of the governmental, material, and social forces which shape the power relations between scientists, policy makers, and public constituencies along axes of capital, race, nationality, gender, and knowledge. By examining the representations of scientists in American popular media, I am not attempting to inscribe a new unilateral configuration between the "American public" and "scientific progress." Rather, my primary method of
approaching this topic has been to presume that neither of these two concepts can be understood as monolithic forces. Certainly, much work has already been done in American Studies and related fields to debunk the notion of a single American public as a meaningful unit of analysis. While this dissertation will certainly be adding to that literature, where it makes a more significant intervention is in the dissection of scientific progress in a similar fashion. The diverse constituencies that make up the American public are mirrored by a complex and nuanced understanding of particular scientific developments. Put simply, the meaning of "scientific progress" is not uniform, varying widely across both different kinds of discoveries and across different segments of the public. The expressions one sees in popular culture are no less than the active struggle to guide the production of scientific knowledge in specific directions. In other words, whether one is speaking about Christian fundamentalists or early-adopter technology enthusiasts, their responses are less rooted in an inherent attitude towards science than in questions of how the research in question will impact their daily lives, who will control the resulting technology, how well oversight and safety protocols have been implemented, who will be conducting the research, and other ethical, moral, and material concerns.

However, this should not be interpreted to mean that the treatment of science in popular discourse is reducible to a question of practical utility. A number of critics, such as Richard Hofstadter, have suggested that American culture is intrinsically hostile to abstracted intellectual endeavors, but readily embraces material technologies. In this formulation, the perceptions of public investments or restrictions on research mirror the internal disciplinary divides between basic and applied research, or at other times

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between science and engineering. I suggest that this is a narrow and rather limiting approach given how images of scientific personnel actually circulate in popular discourse, where such distinctions are rarely made. After all, the Apollo program may have led in fact to a great number of utilitarian technologies, but that is rarely a feature in the cultural mythologies that surrounded it, either then or now. On the flipside, innovators in immanently practical technologies are frequently culturally disregarded – as with industrial design – or even reviled – as with biological engineering. Indeed, most Americans would have a difficult time identifying a single material contribution made by the most celebrated scientists of the twentieth century, from Albert Einstein to Stephen Hawking. Thus, in the cultural wars over scientists, I see a debate not about basic science and applied technology or one about practicality, but rather about the shape, structure, and control over the production of scientific knowledge or technological resources – in a word, governance.

In the postwar era, professional scientists became the symbolic embodiment of the most progressive faith in the ability of people to transcend their circumstances, and a site of anxiety about our utter dependence on the expertise of others. Certainly, images of scientists in American culture long predate my study, including popular figures like Benjamin Franklin and Thomas Edison. But I suggest that scientists and the advances they represent took on an increased salience during the late twentieth century for two reasons. First, the production of scientific knowledge in the twentieth century offered American society a radically increased ability to control our environment in profound and unprecedented ways. Even the revolutionary leaps in nineteenth century technologies were dwarfed in scale by what was to come: in just a few generations, Americans went
from steam-powered rail to manned moon expeditions, from short bursts of information via telegraph to the gushing floods of the Internet, and from TNT to the atom bomb. But this was also an age when individuals were faced with a diminishing ability to grasp a rapidly expanding body of knowledge. Even within the scientific world, knowledge became so specialized that no one could master the entirety of the endeavor. The Manhattan Project, the most spectacular display of the centrality of scientific discovery in this new era, highlighted the severity of this interdependence: it required the dedicated effort of hundreds of minds in dozens of disciplines, no one of whom could hope to marshal the talents in applied and theoretical physics, metallurgy, chemistry, and engineering necessary to produce an atom bomb, much less the military and political logistics of delivering one. For the layperson – even for a science enthusiast – a mastery of this expertise was completely out of the question. As a result of these twin forces, the promise of material abundance and concerns about a growing dependence, cultural mythologies of the scientist formed at the violent nexus of hope and fear about the future.

Secondly, the postwar era in the US witnessed a radical reconfiguration of the relationship between governance and science in the birth of a number of massive state bureaucracies. The federal government has had a role in the production of scientific knowledge since its inception: the Constitution, for example, calls for the establishment of intellectual property laws for the "Progress of Science and the useful Arts." In the nineteenth century, Congress established more explicit commitments to scientific research through organizations like the National Academy of Sciences, but these were largely decentralized and received little funding. And while more direct research oversight was taken during both world wars, these were framed as temporary wartime
measures. As discussed in more detail in Chapter 1, the postwar era was marked by sweeping state commitments to scientific research and development which were unprecedented in scope and permanence, particularly for civilian agencies. The emergent research arms of the federal government quickly became the single largest source of funds across virtually every scientific discipline. This has cemented a link between science and the state in the popular imagination such that the two are inextricably intertwined. Of course, this does not mean the two are always in lockstep – as will be seen, many of the anxieties and hopes surrounding scientists stem from the gap between their role and that of traditional government officials. Nevertheless, the shift in funding and governance structures meant that the world of scientific research became a distinctly public concern, even if the public did not always understand (or was not privy to) the specifics of the research being undertaken.

A few limitations of this study should be noted at the outset. First, as the examination focuses primarily on popular media, the various publics examined herein are a limited subset of the population as a whole. While I have made every effort to look for divergent voices where I could find them, this effort is still restricted to those groups which had the necessary means of production and the consumptive desires to participate in American popular culture. The mass media explored here required a substantial amount of cultural and financial capital to produce and distribute. Thus, for example, while I contrast Afrofuturism's filmic presentations with those of white middlebrow sources in Chapter 3, there are still countless other voices which could not participate in that debate through the same media. Of course, any historical study is limited to the available sources, but I note this here because the absence of certain groups – particularly
those with a more conservative overall attitude towards scientific development – certainly has an impact on my final conclusions. Additionally, it is also important to note that the period chosen for this analysis, beginning with the Cold War and the development of the National Science Foundation, means that the entire project is rooted in the military-industrial-scientific complex. Moreover, the fact that this period marks the rise of the scientific state bureaucracies fundamentally informs the emphasis of this dissertation on the nexus between popular culture and public policy. While questions of funding and control color the resultant representations, this does not undermine my thesis as much as reinforce it, and one could likely expect quite different results undertaking a similar project with another era as the focus. However, the periodization of this project is also limited, in that those policies are bounded by the pervasive influence of the US military-industrial-academic state in popular understanding of science: in a word, while the producers and consumers of US popular culture may have supported the new relationship between science and the state or opposed it, they could not stand outside of it. In different times and different national or cultural contexts, then, one might imagine that policy would hardly be the dominant concern of popular engagement with science.

Finally, a note on the scope of the term "scientist" as it appears throughout these pages. When I describe this project, one of the most frequent initial reactions is to inquire whether this or that group of scientific personnel – doctors, science educators, or sociologists, for example – are included. The simple answer is that, because I'm interested in popular representations of scientists, my use of the term includes anyone configured or received as a scientist in popular culture. As tautological as this response is, it is the only sufficient one. Broadly speaking, we might suggest that a scientist is
someone who rigorously or systematically produces knowledge. But to paraphrase Antonio Gramsci's analysis of intellectuals, calling everyone who engages in scientific activity a scientist is no more useful than suggesting that everyone who cooks a meal is a chef. Rather, a scientist, at least in the popular imagination, is someone who performs a specific social role: the rational application of specialized, frequently technical, expertise. In popular film and literature, this is generally associated with what we might call the natural sciences – physics, chemistry, biology, etc. – but extends through a network of signs to include engineers and technicians, as well as, at times, social scientists such as psychiatrists. While boundaries between, say, science and engineering or between basic and applied research, are significant and useful professional distinctions within the disciplines in which they operate, they are rarely maintained within popular discourse. One need only recall the countless scientists in Hollywood films – Andre Delambre from The Fly (1958), Q from the James Bond series (1962 – present), or Doc Brown from Back to the Future (1985), to name just a few – who identify a problem, theorize the solution, and then whip together a mechanical device to see this principle at work.

There are a few extant approaches to explaining representations of science and scientists in US popular culture. The first is perhaps best typified by Richard Hofstadter, who in 1962 documented a longstanding hostility towards "eggheads" and other learned individuals in Anti-Intellectualism in American Life, pointing to what he identified as a ubiquitous distrust of rational inquiry. He postulated that this pervasive attitude, though it may have become explosively visible during the reactionary McCarthyist scrutiny of the academy during the 1950s, was in fact much more deeply rooted in US evangelical traditions. Hofstadter thus conjectured that there was an essential grain of hostility toward
intellect as a basic faculty which ran throughout US life.\textsuperscript{4} Supporters of this line of reasoning often point to social science research, first undertaken by Margaret Mead in the 1950s and duplicated several times since then, that asks schoolchildren to draw and/or describe scientists. This research sometimes offers conflicting results about whether or not children respect scientists, but suggests more conclusively that they don't particularly admire or trust scientists.\textsuperscript{5}

Similarly, within literature and film studies, there have been several attempts to delineate or examine specific stereotypic images of scientists with the presumption that scientists are generally viewed unfavorably in popular culture. Roslynn Haynes, for example, offers the most comprehensive of these with her examination of fictive representations of scientists dating to Faust. She contends that scientists fall into six basic stereotypes, of which only one is unambiguously positive. In a similar vein of thought to Hofstadter, she suggests that these recurrent negative depictions imply a "widespread, often unacknowledged fear of science and scientists in Western society," owing to their access to specialized knowledge.\textsuperscript{6} The image of the "mad scientist" in various media has held particular attraction for scholars, with book length treatments of the subject from Andrew Tudor, David Skal, and Christopher Frayling. Similarly to Haynes, these scholars generally suggest that this fearful image stems from the scientists' mastery of arcane, esoteric, or forbidden knowledge.\textsuperscript{7}

\textsuperscript{4} Hofstadter.
With a slightly more nuanced outlook, Glenn Scott Allen's is perhaps the closest in spirit to my own in *Master Mechanics and Wicked Wizards*. Allen rejects the notion that all science, as an ontological category, is equally condemned within American popular culture, and suggests that images of the mad scientist and its counterpart, which he dubs the "Master Mechanic" are instead linked to specific cultural and material traditions. Through his attention to visual imagery, he argues that these heroic Master Mechanics are demarcated from their power-hungry and insane counterparts by the practical and material products of their intellectual labors. The "Wicked Wizards" he contrasts them with work in the more ephemeral realm of intellect, without tangible benefit for their communities (and often tremendous risk or harm). Allen thus simultaneously rejects a universalist reading of the mad scientist in favor of a culturally specific one, while also suggesting that the characterization of particular scientists has more to do with the perceived aims of their work than with a predisposition to scientists as a homogenized group.  

While the work of the above scholars has been invaluable in conducting this study, where I break from them is in an insistence on the specifically *historical* dimension of this analysis. Although Haynes and Allen both conduct their studies chronologically, they nevertheless collapse the diachronic elements of their analyses to arrive at unitary and totalizing conclusions about the appearance of scientists in popular culture. Allen suggests, for example, that in his selection of images he was particularly


interested in texts that were widely circulated well-beyond their initial production, with
the notion that the enduring interest must represent the "deepest roots" of a culture's
ideology. 9 Certainly, the fact that a text like Shelley's Frankenstein is still so widely read
is an indication that it finds resonance with the contemporary moment, but it would be a
wild oversimplification to presume that it performs the same discursive function today as
it did at the time of its publication nearly 200 years ago. John Rieder notes, for example,
the dramatic transmutation of Frankenstein's reception over the course of the nineteenth
century. Following its initial publication in 1818, the text was largely regarded as
religious allegory. In the 1880s, in conjunction with the emergence the success of authors
like Jules Verne and H.G. Wells, Shelley's text was reinterpreted as a precursor to the
"scientific romance" genre, and sold four times as many copies as during the previous six
decades combined. As readers engaged the text in connection with Verne and Wells,
greater critical attention was paid to Victor Frankenstein's role as a natural scientist. 10
Regardless of its continued success and circulation, we can no more assume that it carries
the same meaning today than we would assume a hoe-down or square dance in
contemporary Manhattan is equivalent to the same celebration in nineteenth century
Ohio.

The danger in ignoring the historical conditions in which a particular text is
produced, circulated, or received is that one risks minimizing or discarding the relevance
of the real, material conditions underlying the ideological formations in which it
participates and intervenes. As Fredric Jameson quipped, "Croce's great dictum that 'all
history is contemporary history' does not mean that all history is our contemporary

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9 Allen 6.
10 John Rieder. Colonialism and the Emergence of Science Fiction. Middletown, CT: Wesleyan University
history."¹¹ In insisting on the primacy of historical context, I mean to resist the impulse to collapse particular expressive forms into a universalist interpretation of some aspect of the "human spirit" or "Western culture." While specific motifs or narrative tropes may persist or reemerge at various moments in time, my contention is that the meaning of these aesthetic elements is generated through the ways they are mobilized within a set of historical conditions, rather than through a persistent or transcendent set of significatory practices.

Beyond the immediate questions of science and the scientist, this dissertation also enters a larger dialogue within American Studies concerning the intersection between US government policy and cultural forms in the twentieth century. Some of these scholars, such as Barbara Melosh, Michael Denning, and Penny VonEschen, have dealt with explicit forays by government forces into cultural projects through arts funding and cultural exchange programs.¹² Others, like Christina Klein and McAlister, have emphasized the less direct and often unintended interplay between cultural and governmental forces.¹³ This project falls more in line with the latter group, although there are certainly lessons learned from the former: at times, federal research institutions have endeavored quite deliberately to collaborate with cultural producers to engender positive impressions of their role in society, as with NASA during the 1950s and 1960s. Finally,


there is also a good deal of work on twentieth century cultural history which, while it does not always address questions of science or technology, is important in contextualizing this study within the larger schema of postwar history. In particular, historians such as Bruce Schulman, Lisa McGirr, and Donald Critchlow have discussed the rightward shift in American politics following the successes of the Civil Rights Movement. In some respects, I trace a parallel history in the ideological construction of scientists, as the later chapters describe an increasingly individualistic and neoconservative interpretation of the role of scientific agencies. However, the relationship between science and the state also provides potential contrasts to this rightward turn in American politics, as research remains one of the few areas of government spending consistently celebrated by both the right and the left. Apart from a brief stagnation during the 1980s, spending on civilian science agencies has only increased over the postwar era, sometimes rather dramatically even under otherwise conservative administrations. This highlights not only the tremendous political significance of research spending throughout the period, but also a certain cultural flexibility in the way that rhetorics of scientific and technological progress are mobilized to speak to disparate constituencies.

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Theory and Methods

In the interdisciplinary spirit of American studies, I employ a variety of approaches to understand and contextualize the role of scientists in US media. In each chapter, I focus on conducting a discursive analysis of key fictive works, journalistic sources, and political rhetoric alongside critical developments in the political economy of scientific governance. A major influence on this kind of study comes from Roland Barthes, particularly from his work in *Mythologies*. Barthes suggests that certain images, ceremonies, rituals, and commodities become "myths" when they take on the linguistic function of signification. For example, a professional wrestling match, in Barthes' analysis, is not a sporting event, but a spectacle of excess which signals the epic conflict between good and evil, in which the crowd thrills at the punishment of those who transgress social boundaries. This signification, however, is not arbitrary in Barthes' understanding, but politically motivated: myths solidify the ideology of the ruling classes. Moreover, Barthes argues that the spectacular nature of myths is entrancing, that they effectively hide or erase their own signification, while draining the history by which the myth was created. As he writes: "In wrestling, nothing exists except in the absolute, there is no symbol, no allusion, everything is presented exhaustively. Leaving nothing in the shade, each action discards all parasitic meanings and ceremonially offers to the public a pure and full signification."¹⁵ Myths thus place themselves above the ambiguity and unevenness of reality and establish their underlying logics as "common sense:" a unified, totalizing view of reality-as-such.

This function of myth as common sense is particularly salient with regards to the role of science in the postwar imagination. When knowledge is framed and presented

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through scientific rhetoric, it takes on an authoritative air that, much like Barthes' mythology, makes fundamental truth claims about reality while simultaneously effacing the social and political processes that produced these discoveries. In pointing out this similarity between mythology and scientific knowledge, I do not mean to suggest that research agencies or scientists regularly overstate or misrepresent their findings as absolutes – indeed, the researchers who conduct an experiment or establish a new theoretical model are often highly cognizant of the limitations in applying these things more broadly – nor do I mean to reopen an epistemological debate between relative and objective truth or strong and weak social construction. Rather, in making this comparison, I am calling attention to one of the discursive effects of scientific claims: as they circulate more broadly, they are accepted as basic, essential, and most importantly, unmotivated Truths. In other words, as scientific knowledge flows through the semiotic arenas of popular culture and policy making, it elides the material circumstances which produced it in the first place.

As much as this study owes to Barthes' insight about the signification of popular spectacles, this is not to suggest that I view culture as simply reflective of dominant ideology. Indeed, as much as this project is concerned with showing the overlapping orbits of these two forces, it is a profound fascination with their differences that drives this inquiry. To put it simply, policy and culture are far more than mirror images of one another, and the slippage is often much more interesting than the commonality. Popular discourse is not "just ideology" and it is certainly not all "resistance," rather, it is a site of struggle where hegemony is fashioned, refashioned, shifted, pulled apart, and reconstituted every day. As Stuart Hall writes, "Popular culture is one of the sites where
this struggle for and against a culture of the powerful is engaged: it is also the stake to be won or lost in that struggle …. It is not a sphere where socialism, a socialist culture – already fully formed – might be simply 'expressed'. But it is one of the places where socialism might be constituted."\textsuperscript{16} Likewise, a cultural appraisal of science will not emerge wholly constituted in the interests of one party or another. Rather, popular culture is a site where, as consumers, producers, and critics, we take up the political struggle to determine what role scientific progress will play in our lives. Cultural works often produce complex matrices of meanings – even seemingly self-contradictory ones – at different times for different audiences. Thus, while a film like \textit{The Day the Earth Stood Still} may at one level endorse a public faith in scientists and their expertise as a humanist check on weapons development, it can simultaneously express anxiety about technological advances that are rapidly outpacing a common understanding of the scientific principles that underpin them.

On occasion in cultural studies, we have a tendency to lose the trees for the forest – we become so concerned with understanding "Culture" at the level of theory, that we forget to look at which cultural texts are actually proliferating and disseminating. As academics, we often look at the \textit{New York Times} bestseller list or the Nielsen board as so much phantom chicanery or manipulation that we risk committing ourselves to the very kind of prescriptivist conceptions of "Culture" or "Literature" associated with the schools of thought cultural studies was born in rebellion against. Transgressive, underground, and avant-garde works are celebrated, while commercial success is read as a marker of inauthenticity or degraded artistic merit. In demolishing a canon, we establish a new

canon of the "right kind" of popular culture, forgetting that every text, much like every scientific discovery, is a vector of force in an active struggle. The bestseller list and the broadcast ratings are not just passing fashion, nor are they foolproof scoreboards: they are active attempts to determine the very terrain of that struggle. Here, I draw on Bradford Wright's concept of formulas, and the notion that "Put simply, [ideas] that appeal to audiences tend to proliferate and endure, while those that do not, do neither." Thus, the cultural artifacts herein are selected based not only on their critical success, but for typifying repeated or commercially successful tropes as well. This analysis then includes individual seminal works like *Dr. Strangelove* or *2001: A Space Odyssey* for their significant impact on scientists' treatment in film, as well as more diffuse elements such as advertisements for home science kits or *Life's* coverage of the Mercury astronauts taken in aggregate. Additionally, an examination of formulas that span disparate media helps to demonstrate that the ideological struggles at hand are not restricted to a particular form, i.e. that this is not a question of film history or literary aesthetics, per se, but rather emerge from the varied identity groups, political and material interests, and historical conditions that constitute "American culture."

To contextualize these cultural artifacts properly, I also examine a wider body of public thought through historical discourse analysis. Here I rely on an examination of formal policy, i.e. the language of laws, grants, and organizational charters, alongside the ways those policy decisions are framed in the public discourse through speeches, editorials, and policy papers. Although direct science initiatives such as the creation of the NSF certainly play a major role in this analysis, there are also policy decisions not

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typically understood as a part of science policy that have a significant impact on the shape of scientific development in the United States, including immigration reform and the incorporation of forensic science into the criminal justice system. In this area, this dissertation owes a great intellectual debt to scholars in Science and Technology Studies, and particularly the work of systems theorists like Thomas Hughes and social constructivists following from the edited volume *The Social Construction of Technological Systems.* These scholars have made tremendous strides in demonstrating that scientific and technological advancement are powerfully bound to the social systems in which they take place, including systems of labor, capital investment, education, and legislative regulation. While I break from their attention to and emphasis on the evolution of material artifacts in favor of an analysis of culture and the construction of meaning at a discursive level, they have nevertheless significantly expanded my thinking to consider a substantially wider array of social and economic forces in my analysis of science and technology.

Finally, Melani McAlister's *Epic Encounters* has had a particularly significant role in the theoretical formulation of this study. She contends although policy and culture are not entirely coterminous, nor do they function in the same ways, they are mutually productive of meaning. Each of these fields has their own domains, formal qualities, and historic trajectories which obviously differ from one another, but the interaction between the two becomes a key site for establishing understandings which, through repetition, become naturalized and taken as authoritative. Thus, she argues that "cultural productions

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help make meanings by their historical association with other types of meaning-making activity … This suggests what we might ask less about 'what texts mean' – with the implication that there is a hidden or allegorical code to their secret meaning – and more about how the texts participate in a field, and then in a set of fields, and thus in a social and political world." Similarly, a central argument of this dissertation is that although science, politics, and culture are three different fields, all three are semiotic activities through which we create, alter, and reify meanings. My efforts to demonstrate the intersections and overlaps between these meaning-making activities is not an effort to suggest that they simply mirror or reflect one another: indeed, the interaction between the three is frequently messy and contradictory. But it is precisely this contact, messiness and all, that creates the basic discursive framework through which we understand the significance of science and its relationship to the public good.

Chapter Outline

The chapters that follow are arranged chronologically, and each also focuses on the discourse surrounding a single scientific discipline. This is intended to serve the twin aims of privileging a historical mode of analysis and attending to the heterogeneous character of scientists in American popular culture. To ground each chapter in the material concerns of the era, I focus on a single major policy development or institutional reorganization. Approaching the project this way is an effort to balance depth of analysis with breadth: that is, to show both the weight and cultural penetration of particular concerns against the backdrop of historical shifts and transitions. This is not meant to suggest, of course, that the material forces or ideological formations under discussion

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19 McAlister 8.
either emerged from the aether or evaporated at the end of the period in question and, indeed, I have tried to highlight the continuity of these forms wherever possible. Nevertheless, there are of course limits to this approach: namely, in rooting the interrogation in the dominant policy issues and cultural concerns of a particular moment, other concerns are inevitably sidelined or neglected. The growth of the environmentalist movement, for example, from Rachel Carson's critique of the chemical pesticide industry in *Silent Spring* (1962) through the contemporary concerns surrounding human contributions to global warming, constitute a policy arena rife with implications for cultural formations around science and technology, but also one which resists a simple integration with either the periodization or the disciplinary focuses of the present work.

Chapter one focuses on the immediate postwar era and the establishment of the National Science Foundation [NSF]. Pitched as a permanent, peacetime continuation of the alliance between research agencies and the federal government established during World War II, the NSF introduced significant questions about the proper role of scientists in the government. While popular discourse expressed substantial enthusiasm for the promised improvements in quality of living and national security offered by this alliance, marked fears about a potentially antidemocratic dependence on scientific personnel emerged as well. In connection with popular science fiction films including *The Day the Earth Stood Still* and *Dr. Strangelove: Or How I Learned to Stop Worrying and Love the Bomb*, I read the initial celebration and subsequent denigration of Robert Oppenheimer as emblematic of the concerns surrounding the governance of the new civilian science institutions.
Chapter two turns to the phenomenal emotive resonance of the manned space program during the 1960s. As the largest peacetime federal expenditure in history, the Apollo program not only generated a national fascination with space science, but managed to mobilize complex and sometimes contradictory narratives about its purpose. NASA’s manned exploration program was hailed as central to a range of national priorities from Cold War military supremacy to civil rights and international cooperation. I argue here that the Gemini and Apollo astronauts were able to simultaneously embody these competing motives through the mobilization of the spatial metaphor of the frontier and a reinvigoration of American myths of the frontiersman.

The relationship between the biological sciences and the emergence of Afrofuturism form the core of chapter three. Although the Tuskegee experiment, officially titled "Untreated Syphilis in the Male Negro," had been ongoing since the 1930s, it sparked a cultural firestorm in the popular press in 1972. The highly unethical study, which put at risk not only the nearly 400 infected men who were part of the study but also their sexual partners and children, highlighted the deep divisions between the priorities of federal research agencies and African American communities in the United States. Through an examination of the work of Afrofuturist pioneer musician and filmmaker Sun Ra, I argue for Afrofuturism as a concerted aesthetic response to this division. Ra's work upends the divide between white scientists and vulnerable black bodies to not only imagine a world in which blackness is synonymous with high technology, but to create one.

In chapter four, the privatization of the Internet forms the key backdrop against which software moguls became highly celebrated technological entrepreneurs. Despite
the roots of computing and digital networks in state and corporate bureaucracies, these entrepreneurs became the primary figures associated with the rapid proliferation of digital technologies. Here, I read the fusion of the countercultural hacker and the socially maligned nerd as central to reformulating the public perception of computer science to a distinctly private enterprise. Through the invention of a disenfranchised past as nerds, these men, largely from white, middle-class backgrounds, became the poster children for neoconservative beliefs in the power of free markets and technological innovation to level the social playing field.

Chapter five looks at forensic scientists and the success of scientific procedurals on post-9/11 television. A multitude of television series featured forensic scientists as protagonists, even while a host of high-profile conviction reversals were very visibly demonstrating the weaknesses of forensic evidence. These fictive forensic scientists operate with rational certainty and absolute reliability, successfully identifying perpetrators week after week on prime time television. Through a discussion of three of these series – CSI, Numb3rs, and Bones – I demonstrate that forensic scientists are consistently represented in familial relationships with state agents. I argue here that the intimate nature of these relationships serves the dual purpose of both bolstering the belief in science and the state as rational actors and of justifying the permanent state of crisis under the War on Terror.

Finally, the conclusion returns to the broader concerns outlined in this introduction, through a brief reflection on popular images of scientists in the contemporary moment. Contrasting the rhetorics of Barack Obama, the first "nerd president," with the satire of Stephen Colbert, I demonstrate that the tension between
hope and anxiety surrounding the public investment in scientific research is alive and well. I close by suggesting that the discursive move towards viewing the scientist as a representative of private interests, highlighted in chapters four and five, has generated a veneer of partisanship and a general distrust of the intersection of science and politics.
Chapter 1: Governing the Endless Frontier

In late 1953, William Liscum Borden sent a letter to J. Edgar Hoover, the director of the Federal Bureau of Investigation [FBI], making a host of accusations against J. Robert Oppenheimer and his past affiliations with communists and fellow travelers. The claims in the letter alternated between facts about Oppenheimer's history which were already well documented by the FBI and baseless conspiracy theories which rivaled Joseph McCarthy's wildest fantasies. Nevertheless, Oppenheimer, the former director of the Manhattan Project and "father of the atomic bomb," would soon find himself removed from his advisory post at the Atomic Energy Commission [AEC], stripped of his security clearance, and labeled as someone who could no longer be trusted with the atomic secrets he had helped develop.

Undoubtedly, the anti-communist fervor of the early 1950s played a critical role in the Oppenheimer hearings and their interpretation by the public. However, it would be a gross oversimplification to dismiss Oppenheimer's removal as just another political witch hunt of the McCarthy era. Significantly, the official findings of the AEC acknowledged that the allegations of espionage and treason were essentially unfounded. Every witness called during the hearing, including those for the AEC, acknowledged that Oppenheimer was not only loyal, but exceptionally careful in his measures to secure classified documents and information, above and beyond the standards of his peers. Rather, as Philip Stern's seminal analysis of the case demonstrates, the decision of the AEC administrators hinged instead on Oppenheimer's refusal to abdicate his better

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20 Prior to the AEC hearings, Oppenheimer had openly testified before Congress on multiple occasions about many of his past involvements with 'fellow traveler' organizations. As will be discussed later, those items that were not a matter of public record were documented by the AEC and the FBI as part of his initial security clearance.
judgment in favor of the strictures of the security state, and in particular his failure to endorse enthusiastically the development of the hydrogen bomb.\textsuperscript{21}

Beyond the official decision, the case took on new dimensions when it became a matter of public scrutiny. The polarized public reaction to the hearing, as it played out in letters and editorials in US newspapers and magazines, is partially reflective of the growing political divides over anticommunism, political censorship, and the threat of nuclear war. As with the official findings, however, it would be remiss to suggest that these factors alone accounted for either the range or the passion of the public debate. Instead, a significant current that swirled throughout the middlebrow press in the months after the hearing was a debate over the proper relationship between scientists and government. Ought they be restricted to acting solely as theorists and technicians, or was it acceptable – even desirable – for them to comment on non-scientific matters, such as morality and politics? Was it useful to have a human check on scientific discovery in an age where such advances carried the capacity for widespread devastation, or did that leave the state beholden to the will of a few individual experts?

These questions took on an enhanced significance in the postwar era as the federal government adopted a radically new relationship to scientific research, and scientists themselves were consequently placed in a new relationship to both the lay public and the state. Scientific progress was consistently advocated as central to the Cold War state's ability to provide for both national security and domestic economic welfare. Rendering scientific progress an essential function of the state meant an increased dependence on scientific expertise, and consequently on scientists. Compounding this dependence was that fact that few people outside of the scientific community itself could credibly claim to

understand the work that they were doing in an era of rapid technological advances and theoretical breakthroughs. This raised significant anxieties about democratic oversight and governance: could a state agency, or for that matter the public which ostensibly granted it authority, meaningfully control the research – and, for that matter, the researchers – it was supposed to be funding, managing, and directing?

In retrospect, that Oppenheimer should be the individual at the center of these debates in the 1950s seems fitting. Following the conclusion of World War II, he became arguably the most famous scientist in the United States for his leadership in the Manhattan Project. Prior to his security hearings, he wrote and spoke at length and with a unique set of credentials about the need for international cooperation and political restraint in a world where militaristic saber rattling could result in human extinction. A handful of other individual scientists of the era, like Albert Einstein, may have better captured the popular imagination in the long view of history. Still others, like Vannevar Bush, may have had more powerful (or at least diffuse) influence in the creation of national policy. But in the mid-century none so neatly wed these two arenas as Robert Oppenheimer. Among his peers, he was the epitome of the public scientist: an active agent in the production of the emerging state scientific institutions, but still, as the security hearings made patently clear, very much a subject of state demands to produce particular kinds of knowledge. In this light, it seems inevitable that he would find himself at the heart of the emerging ideological struggle over scientific progress, state power, and the role of scientists in public life. However, the particular alignment of state priorities, scientific institutions, and Cold War politics that rendered science a state necessity while
simultaneously rendering particular scientists as political liabilities was anything but
inevitable.

The belief in science as central to material progress and national security
remained firm in popular discourse during this period. Nevertheless, despite the scientific
enthusiasm in public culture, there was also a consistent undercurrent of anxiety about the
new power of these state scientific agencies and the public dependence on their
personnel. This anxiety would be far more visible over the coming decades as fears of
nuclear annihilation became more pronounced, but the seeds of this concern were already
present even in the initial debates over the structure of the NSF. Thus, it was no accident
that in his presidential farewell address, President Dwight D. Eisenhower issued a
warning not only about the growing political dominance of a "military-industrial
complex," but went on to suggest that "we must also be alert to the … danger that public
policy could itself become the captive of a scientific-technological elite." This distress
about a growing dependence on scientific experts was a consistent undercurrent in
popular discourse throughout the era, and it played a particularly salient role in the public
reaction to the Oppenheimer AEC hearings. Oppenheimer, who was a widely celebrated
figure in the immediate postwar era for both his scientific expertise and humanistic
concerns about the cataclysmic significance of atomic weaponry, soon found himself
under attack in the popular press for precisely these same characteristics. To understand
this transition, it is crucial to examine the reaction to his hearing within the context of the
emergent research wings of the federal government.
From OSRD to NSF

The postwar era in the United States saw an unprecedented expansion of the federal government's long-term investments in science. Building on the alliances that had been so crucial to the war effort, Congress established a number of major research institutions to pursue both basic and applied research. The National Science Foundation [NSF], the National Institutes of Health [NIH], the Advanced Research Projects Agency [ARPA], the Atomic Energy Commission [AEC], and the National Aeronautics and Space Administration [NASA] were all founded or radically restructured within a ten year period, marking massive expansions in the funding commitments to science relative to the prewar period.

It is tempting to regard these commitments as simple continuations of the collaboration between the federal government and the scientific community established during World War II. After all, most of these institutions had nascent corollaries during the war. The Office of Scientific Research and Development [OSRD] coordinated much of the wartime research in basic science that would later be funded by the NSF, as well as studies in nutrition and medicine that later came under the purview of the NIH. NASA was a direct reorganization of the National Advisory Committee for Aeronautics, which had conducted research and testing of military aviation technologies as early as 1915. And, of course, the AEC, including many of its initial key advisory personnel, was born directly out of the end results of the Manhattan Project.

However, the central distinguishing feature of the postwar federal investment in science was permanence. Like some of the other expansions of federal power during World War II – most directly seen in the huge numbers of standing, active-duty military
forces, but also in the development of intelligence industries and subsidies for the manufacturing sector – the federal investment in science was initially pitched with regard to a single goal: Allied victory. The urgency of global conflict gave Franklin D. Roosevelt's administration a good deal of leeway to create new programs and expand existing ones. Similar efforts to expand the federal government's role in the civilian sector under the New Deal were likewise framed as a response to an immediate crisis, and often still faced conservative criticism. However, continuing these commitments after the war – with no open military conflict or economic crisis at hand – required some fundamental shifts in the view of the federal government's proper role and the underlying political ideology that would coalesce in the security state. These new agencies were not a response to an emergency, but rather a commitment to scientific research as a means of creating and ensuring a way of life.

It is difficult to overestimate the role of one man, Vannevar Bush, in reshaping the federal government's relationship to science in the postwar era. Bush, as head of the OSRD during the war, had firsthand knowledge of the tremendous potential benefit of federal support for the scientific community. The OSRD, by coordinating the efforts of American universities, research laboratories, and scientific personnel made tremendous progress across a variety of fields central to the war effort. Radical improvements to detection technologies like radar and sonar, new medicines and new mechanisms for production which facilitated their worldwide distribution to soldiers at the front lines of battle, newer and more efficient fuels, fertilizers, and pesticides, and larger and more accurate bombs, were all created in a few short years. Perhaps the most awe-inspiring

demonstration of the government's ability to coordinate and subsidize scientific efforts was seen in the Manhattan Project, which organized the efforts of hundreds of scientists and technicians at dozens of laboratories, enrichment facilities, and test sites throughout the country and abroad. This coordination would lead, of course, to the successful creation of atomic weapons, their deployment against two major Japanese cities, and the subsequent rapid conclusion of the war in the Pacific less than six years after the Project's launch.

It is no wonder, then, that Vannevar Bush looked to a continued alliance between the federal government and the scientific community as one of the principal mechanisms to improve science and the public good at the close of the war. Commissioned by Roosevelt in 1944 to study how the benefits of the OSRD might be made available to the public at the close of the war, Bush wrote the seminal *Science: The Endless Frontier* to advocate this very end. What started primarily as a report to explore which technologies might be released without jeopardizing national security became a blueprint for the collaboration between scientists and the federal government in a postwar world.

Bush's vision here was far-reaching and prescient. In *The Endless Frontier*, he advocated the creation of a single federal body – the National Research Foundation – to coordinate all federal investments in basic science, regardless of field or potential application. He opposed a return to the prewar era in which the government created particular agencies to tackle specific projects – e.g. military aviation or vaccines – through disparate and isolated funding channels or laboratories, leaving research that did not fit neatly into these narrow channels out in the cold. He claimed "Science is fundamentally a unitary thing. The number of independent agencies should be kept to a
minimum. Much medical progress, for example, will come from fundamental advances in chemistry. Separation of the sciences in tight compartments, as would occur if more than one agency were involved, would retard and not advance scientific knowledge as a whole."

In particular, Bush was concerned with developing basic science in America. Basic science – that is, research without any immediately foreseeable application – is difficult to fund privately, for obvious reasons. These projects require long term investments, most of which may never return any kind of fiduciary reward. But it was pre-war European advances in basic science that had laid the ground work for most of the technological breakthroughs during World War II. In *The Endless Frontier*, Bush expressed concern that were another global conflict to arise in the near future, the US would no longer be able to capitalize on European breakthroughs in basic science. This was particularly true in a postwar world where European infrastructure and economies had been laid to waste.

At the heart of *The Endless Frontier* was a link between science and the public good. In his letter of transmittal to Roosevelt, Bush identified the major themes of how federal science funding could be of public benefit: "The rewards of such exploration both for the Nation and the individual are great. Scientific progress is one essential key to our security as a nation, to our better health, to more jobs, to a higher standard of living, and to our cultural progress." Bush proceeded to identify how each of these areas – security, health, industry, and intellectual understanding – had already been served by the OSRD and could be pursued further by a new civilian agency in the postwar world.

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23 Bush 32.
24 Bush 2.
Bush made repeatedly clear, however, that despite its civilian nature, the agency could be of immense importance in establishing national security. "In this war it has become clear beyond all doubt that scientific research is absolutely essential to national security. The bitter and dangerous battle against the U-boat was a battle of scientific techniques – and our margin of success was dangerously small .... There must be more – and more adequate – military research during peacetime. We cannot again rely on our allies to hold off the enemy while we struggle to catch up."25 Perhaps due to Bush's involvement in the war effort, the language of defense and security are pervasive in the document, even in ostensibly peaceful branches of research. He casts the need for medical research, for example, as part of the "war against disease," and many of his recommendations begin with provisos such as "consistent with military security," or "with the prior approval of military authorities."

Following the war, other scientists tried to make the case that public funding of civilian science would be one of the surest ways to connect science to the public good as well. Although scientists of the era were generally leery of continuing the kind of direct oversight that had occurred during wartime, they also knew that a return to exclusively private funding would limit research which did not promise direct commercial application. For example, W. Parker Anslow, representing a consortium of scientists lobbying in favor of the foundation, chided the idea that science could be adequately funded through tax incentives to private investors, claiming that "Leaving the support of science to private philanthropy is certainly the best means of insuring that science will

25 Bush 17.
continue to operate in a cul de sac. Thus, scientists were making the case that a public body of funding was not just necessary for their own continued livelihood, but for the successful integration of scientific research into the democratic body.

Although the average citizen may not have had a firm understanding of atomic physics or how a particle accelerator functioned, the middlebrow press did embrace the need for a civilian basic science agency that would fund these items. While there was some debate over the particular governance structures or funding mechanisms of the proposed agencies, editorial after editorial in the major newspapers claimed a consensus behind the need for a civilian-led federal science program. Further, like Bush, the middlebrow press acknowledged the need for basic science apart from applied research by industry or the military. *Time* magazine, for example, ran an article in 1947 titled "Science: The Military Moves In," expressing concern over delays in creating a civilian research agency. "Is the military about to take over US science, lock, stock & barrel, calling the tune for US universities and signing up the best scientists for work fundamentally aimed at military results? …. While Congress is bogged down over bills for an atomic energy control commission and a national science foundation, which are intended to restore science to the scientists, the Army & Navy are signing contracts." While funding for military research grew to over $1 billion through the Army, Air Force, and Navy research centers, by promoting "science for the scientists," *Time* acknowledged that there was more for science to offer than through defense alone.

As noted above, the postwar era did in fact see a proliferation of federal agencies with overlapping areas of focus from the NIH to the AEC, thus thwarting Bush's desire

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for a unitary agency. However, with the creation of the NSF in 1950 Bush's wish for a single foundation to fund science across disciplines, at least for basic research, was finally instituted. The five year delay between the conclusion of the war (and the three year wait after dismantling of the OSRD in 1947) represents a hard fought political battle over the ultimate size and shape the agency would take. While there was a political consensus around the need to fund scientific research in the wake of World War II, there was significant debate about the scope and structure of an agency charged with funding such a diverse body of research. Although the scale of the agency – and thus its attendant cost – was one of the major issues under debate, the other central concern was the oversight and governance of the program.

If the NSF would fund projects across a plethora of fields, including basic science with no discernible immediate application, how would the agency determine which projects were worthy of funding? Direct control by Congress or appointed bureaucrats, scientists argued, would lead to narrow and shortsighted research focused on the immediately practical or politically expedient, greatly curtailing scientific freedom. On the other hand, Congressional critics suggested that funding a research agency with no oversight would be a sinkhole for federal funds, with scientists pursuing their pet projects with little concern for what might benefit the public good. Legislators put forth numerous competing bills with different management structures and funding mechanisms for the agency between 1945 and 1949. For the most part, these were variations on one of the two initial bills put forth in 1945 by Senators Magnusson and Kilgore. The former, championed largely by the scientific community, adhered more strictly to the regimen laid out in *The Endless Frontier*, delegating funding authority to a board made up of
experts in their respective fields and restricting distribution of funds to grants. Kilgore's model, on the other hand, advocated a New Deal approach to the agency, in which research funding would be under public control and would further need to be directly linked to economic development.  

This dispute over administrative control of the proposed agency reached a head in 1947 when President Harry Truman vetoed the first bill for a National Science Foundation to pass both houses of Congress, on the grounds that while it created a new agency in the executive branch it did not allow enough oversight by the president. The structure of this bill authorized the president to appoint the board for the Foundation, but from there the Foundation would be largely autonomous. The board would appoint its own director and department heads which, in turn, would be answerable only to the board. According to some analysts, this legislation created a director which in some matters of science and research outranked the president's own cabinet members, without giving the president any power to directly appoint or revoke the director. One editorial in support of the veto noted "Science does not stand apart in a democracy. It is entitled to no more privileges and rights than commerce, the law or economics. The President is clearly right in holding that the method of administration advocated for the National Science Foundation 'implies a distinct lack of faith in the democratic process."  

Ultimately, Bush's vision for the structure of the agency largely won out over those of his detractors when the National Science Foundation Act of 1950 passed, even if the overall size was initially much smaller than he requested. Rather than directly running laboratories, the Foundation would oversee the distribution of grant funds through

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partnerships with universities and independent researchers. Decisions as to how to award these grants would be conducted by civilian boards overseeing major areas of research, composed primarily of specialists in the field being funded. As Bozeman and Blankenship note, this "operates much like the system of peer review employed by editors of academic journals for evaluation of prospective article." The intended effect of this was to minimize control of or interference in scientific research by outside bureaucrats. Instead, decisions over the direction of basic research would be left primarily to professional scientists. This structure represented a substantial investment of trust in the scientific community, but it also highlighted a growing institutional dependence on scientific knowledge which appeared opaque and arcane to the larger public.

**Oppenheimer and the FAS**

Of course, even prior to the institutional authority granted by the National Science Foundation Act, a number of scientists were already significant public figures in the postwar era. In particular, following the detonation of the atomic bomb at Hiroshima, the scientists attached to the Manhattan Project became household names and national heroes. Most Americans believed that the development of the atomic bomb had saved them from a bloody invasion of Japan. Further, maintaining superiority in atomic weapons quickly became the central plank of Cold War defense strategy and with it, nuclear scientists the iconic cold warriors. As historian David K. Hecht notes: "The advent of the atomic age in August 1945 was one major impact on cultural conceptions of 'the scientist' …. Important questions about nuclear weapons made science – and

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therefore, scientists – central to the political, ethical, and social dilemmas that dominated much public discourse in the United States during the 1940s and 1950s." \( ^{31} \)

Oppenheimer in particular emerged as one of the most celebrated public faces of science in the late 1940s and early 1950s. Following the war, he accepted an appointment as the director of the Institute for Advanced Study, a private institution where he oversaw research by some of the top scientific minds of the day. He also held, by President Truman's appointment, an advisory post on the Board of Consultants for the AEC. Indeed, when he appeared on the cover of *Time* magazine in 1948, the editors suggested that he was more important to the world of nuclear physics than Albert Einstein. Notably, it was primarily Oppenheimer's ability to marshal scientific minds and resources as an administrator and bureaucrat, rather than his direct contributions to physics, that came to define his postwar career. It was also this ability that would ultimately prove central to the revocation of his security clearance at the AEC hearings.

Hecht argues that this laudatory public image was contingent on frequent representations of Oppenheimer's life and thought outside of science. Oppenheimer was viewed as a renaissance man, and newspaper coverage was as likely to discuss his love of poetry or his time horseback riding on his family's ranch as they were his expertise in nuclear physics. Hecht writes,

*Portrayals might emphasize a variety of roles for Oppenheimer: as humanist, moralist, patriot, intellectual, adventurer, or activist. But though the images differed and perhaps drew distinct audiences into his orbit, each fulfilled a similar function: each allowed people to see him as something other than just a scientist.*

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Interestingly, such contextualization did not stem from an anti-science impulse – Oppenheimer remained very much a scientific icon. Perhaps paradoxically, however, his fans needed to sense a persona outside of science in order to admire him as a scientist.\footnote{Hecht 944-5.}

Nevertheless, it was a topic distinctly related to contemporary science that he spoke most frequently about: specifically, the results of his own research on atomic weapons. Beginning immediately after the war, Oppenheimer began advocating international, civilian control of nuclear research. Literally within days of the war's conclusion, Oppenheimer and other Manhattan Project alumni began to organize, as Philip Stern notes: "On the evening of August 30, 1945 – sixteen days after the surrender of Japan – a new organization was born: the Association of Los Alamos Scientists, ALAS for short. It represented a determination on the part of the scientists to act as a group in trying to influence postwar nuclear policy."\footnote{Stern 84-85.} Their immediate aims were to ensure that long term control over nuclear research and material would be in civilian, rather than military, hands.

The group quickly reincorporated as the Federation of American Scientists [FAS]. The FAS was a key supporter of the McMahon Act, which established the AEC and created a path forward to civilian oversight of atomic energy development. Scientists within the FAS saw public education about the perils of atomic warfare and transparency of information about nuclear physics as the primary means to ensure the passage of the act. To that end, they gave public talks, wrote papers and letters for the popular press, and created and distributed educational materials and pamphlets highlighting the need for
oversight of nuclear weapons development. The act, renamed and passed as the Atomic Energy Act of 1946, established the AEC. Oppenheimer served on the General Advisory Committee [GAC] of the AEC for the next seven years, before he faced a loyalty hearing from the very same agency.

Oppenheimer was a member of and endorsed the aims of the FAS, but it is important to note that he generally advocated a fairly moderate position, and encouraged his fellow scientists to do the same. For example, when ALAS was first forming, Oppenheimer discouraged them from issuing a group statement to avoid the appearance of political heavy-handedness, and suggested instead that the scientists could individually write letters and speak to legislators to advocate civilian control. He discouraged the other members of the FAS from abusing their positions or their influence, as most of them were well-placed in well-regarded research institutions by this point, and instead pushed the organization to stick to its twin missions of education and transparency.

It is also important to note that Oppenheimer, in his capacity at the AEC, continued to advise on the development of atomic weapons. Generally speaking, he favored the development of smaller, tactical warheads and opposed the development of the hydrogen bomb, otherwise known as "the Super," until after 1949 when Truman directly ordered the AEC to proceed with its development. That his opposition to the hydrogen bomb was limited, in his advisory capacity, to technical and strategic considerations, would not stop it from becoming a defining issue at his security hearing, as will be discussed below. Nevertheless, he continued to advise and offer technical

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35 Stern 85.
support on a range of potential nuclear applications from refinements to the atom bomb to electric power to mining and space travel. Further, while popular history has made much of his statement two years after the war that "the physicists have known sin," he was quick to disavow any personal guilt for the creation or deployment of the atomic weapons. Instead, he argued that mastery of the atom was a necessary or inevitable technological advance, and the question, now, was how best to manage it.36

But while Oppenheimer was never exactly a pacifist, he had continuing concerns over the ethical role of scientists and the potential for mass self-destruction in the atomic age. Oppenheimer wrote and spoke publicly extensively during the period from 1945 to 1953. He gave interviews to magazines, published essays, and advocated tirelessly for establishing international civilian organizations to oversee nuclear development. Notably, however, he maintained his belief that they could only be accomplished by a well-educated public with access to information about the dire consequences of nuclear war, as opposed to through the institutional authority he held at the AEC. In a lecture broadcast on the BBC in 1953, he argued that:

This open access to knowledge, these unlocked doors and signs of welcome, are a mark of a freedom as fundamental as any …. The multitude of communities, the free association for converse or for common purpose, are acts of creation. It is not merely that without them the individual is the poorer; without them a part of human life, not more nor less fundamental than the individual, is foreclosed …. The open society, the unrestricted access to knowledge, the unplanned and uninhibited association of men for its furtherance, these are what may make a

36 Thorpe 216.
vast, complex, evergrowing, ever-changing, ever more specialized and expert technological world nevertheless a world of human community.\textsuperscript{37}

Moreover, Oppenheimer was deeply critical, both publicly and privately, of the official nuclear defense policy promoted by the Strategic Air Command [SAC], which centered on developing overwhelming retaliatory capabilities – a policy that would later come to be better known by the moniker of mutual assured destruction. In a 1953 article for \textit{Foreign Affairs}, he wrote: "A high officer of the Air Defense Command said – and this only a few months ago, in a most serious discussion of measures for the continental defense of the United States – that it was our policy to attempt to protect our striking force, but that it was not really our policy to attempt to protect this country, for that is so big a job that it would interfere with our retaliatory capabilities. Such follies can occur only when even the men who know the facts can find no one to talk to about them, when the facts are too secret for discussion, and thus for thought."\textsuperscript{38} His opposition to mutually-assured destruction as the foundation for sound atomic policy not only led to his reluctance to support research on the hydrogen bomb, but it earned him a number of well-connected political enemies as well.

Nevertheless, during the period before his AEC hearing, Oppenheimer's political activities were well-received by the middlebrow press. A 1945 article in \textit{Time}, for example, read "Last week, just before he resigned to go back to teaching physics, tough-minded, 41-year-old Dr. Oppenheimer made the smartest statement of all the scientists who were cautioning Congress to watch its atomic step. Dr. Oppenheimer halfheartedly supported [retaining military control of atomic research], but insisted that its concept of

total control should not be the 'pattern for the future.' Oppenheimer's stance in favor of international oversight of atomic research rather than an arms race – a position that might well have been seen as weak-willed or accommodationist coming from someone else in the early years of the Cold War – was received as a voice of sober, scientific reason from the father of the atomic bomb.

This celebration of scientists as romantic figures who might exert a moderating, humanistic influence on technological development was not limited to Oppenheimer or the atomic scientists alone. As Rae Goodell argues, a critical advance in the celebrity of scientists during the postwar era stemmed from their ability not only to communicate the scientific merits of their ideas, but to skillfully exert their influence in the politics and policy-making of science. Goodell suggests that the personalization of science in prominent, outspoken figures like Carl Sagan and B.F. Skinner actually helped to democratize what could sometimes be seen as an elite or out of touch profession. While scientists who participated in public policy debates were sometimes controversial figures, they were nonetheless crucial figures in humanizing their esoteric professions.

However, even before Oppenheimer's security hearings began, cracks in his universal acclaim began to appear. As the Cold War escalated, hawks began to cast doubt on Oppenheimer's position as a voice of moral conscience. Particularly after 1949 and the first successful Soviet atomic test, his internationalist spirit was occasionally viewed with suspicion, even if he maintained a positive image overall. A July 1953 article in Fortune, for example, alleged that there was an internationalist conspiracy among some prominent nuclear scientists and named Oppenheimer specifically. The article advocated, at a minimum, his removal from positions of official influence, expressing concern that any

unelected individual should hold that much power. Just a few months later, the AEC hearings would accomplish just that, and after they were made public, Oppenheimer would see much of his unofficial influence evaporate as well.

The ambivalence between celebrating scientists as heroic icons and an undercurrent of anxiety about their growing influence on policy-making is a consistent feature in the treatment of scientists in popular film during this period as well. For example, when *The Day the Earth Stood Still* debuted in 1951, it spoke both directly and metaphorically to Cold War anxieties about the impact of atomic weapons, the rise of a national security state, and the increasing reliance on scientific expertise in the new technological milieu. The film, based on Edmund H. North's short story "A Farewell to the Master," immediately garnered attention from both critics and popular audiences. While initial box office receipts were moderate, a number of critics counted it among the best films of the year, and its score and characterization earned lasting places in the conventions of science fiction film in American popular culture. Both the narrative and filmic elements at play point to several features of the emerging mythology of scientists as policy makers.

The plot of *The Day the Earth Stood Still* is simple to the point of bordering on the allegorical. Klaatu, a humanoid representative from an intergalactic consortium of civilizations, lands a spaceship in Washington, DC on a diplomatic mission. He intends to meet with all the world leaders to impress upon them the importance of abandoning international aggression now that they have mastered the power of the atom. When this plan falls apart due to the political exigencies of the Cold War, Klaatu escapes from the US military and takes up residence at a local boarding house. After spending time with

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40 Stern 202.
ordinary people and touring Washington, Klaatu decides to meet with an international
group of scientists instead of the political heads of state. Before he can conduct this
meeting, however, his whereabouts are betrayed to the army by one of the residents of his
boarding house, and he is shot and killed. Klaatu's giant robot, Gort, resurrects him long
enough to issue a final warning: if humankind attempts to export its military aggression
beyond the boundaries of our solar system, humans will be eradicated.

The film's opening sequence immediately calls attention to the role of science and
technology in the postwar era. The opening low angle shot of rotating radar dishes
suggests a hulking and slightly menacing presence. The particular history of radar –
developed secretly and independently by multiple nations during World War II – and its
importance to the war effort would not have been lost on contemporary audiences. As
radar operators, first in the US and then around the globe, spot Klaatu's ship, they express
helplessness that it is much too fast to track. The complete dependence on scientific
progress for national security is thus driven home.

Cyndy Hendershot has suggested that Klaatu is a stand-in for the postwar
scientists' movement, including Oppenheimer's involvement with the FAS, pushing for
international control of atomic weapons.41 Certainly, there is much to support a reading of
Klaatu as a figure of scientific progress. During his initial appearance, he intends to offer
a technological gadget as a diplomatic gift to the US president. Although it is destroyed
before it can be given, the gift signifies Klaatu as a harbinger of technological progress.
Likewise, Klaatu corrects a mathematical equation in progress by Dr. Barnhardt, a
prominent physicist, as a means of establishing rapport. And throughout the film, by

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Web. 3 Sept. 2011.
virtue of his position as an alien from a futuristic society, Klaatu demonstrates mastery over technology far beyond the understanding of the US scientific and military elite shown in the film.

Additionally, as Hendershot notes, Klaatu explicitly shares the political goals of the real world FAS – an end to atomic warfare. During his final speech in the film, he explains the tools and protocols the intergalactic peacekeepers use to prevent aggression, which appears as a political endorsement of the Baruch Plan, promoted by J. Robert Oppenheimer and other scientists, which called for the international civilian control of atomic research and development. Some of Klaatu's final dialogue seems a direct response to the Plan's critics, who claimed that any international oversight would lead to leaks in atomic security, when he suggests "We do not pretend to be perfect, but we have a system and it works." Quite similarly, scientists like Oppenheimer endorsed the Baruch Plan as a pragmatic measure, noting that while no system would be foolproof, cooperative international control would be immeasurably better than continuing atomic research by warring nation states.

However, this reading of Klaatu-as-scientist is challenged by several factors. At the most obvious level, the overt religious symbolism attached to Klaatu lends itself to reading him as a Christ-like prophet. Klaatu descends from the heavens on a mission of peace and sacrifices his own life in pursuit of that mission. Further, after he is resurrected for a short time he indicates that power over life and death is reserved for the "Almighty Spirit." This would seem to position him less as a scientist and more as a prophetic figure or moral conscience.42 However, as Hecht's analysis of Oppenheimer's role in the early

postwar era indicates, these two categories were not intrinsically opposed in Cold War public culture – for example, Oppenheimer was also looked to as both a scientist and a voice of conscience. Additionally, reading Klaatu solely as a scientist is challenged by the fact that neither the film's plot nor Klaatu himself presents his role in that light. Rather, Klaatu positions himself as an explorer and ambassador. While he does demonstrate significant scientific expertise, there is little in the film to suggest that this is in any way extraordinary among the peoples he represents on his diplomatic mission. Hendershot's reading, however, suggests an easy slippage in the film between the categories of "scientist" and "statesman," as Klaatu's ambassadorial efforts on behalf of an outside political entity can be understood as functioning on behalf of the scientific community.

The slippage between Klaatu's position as a scientist and as a statesman is mirrored in the presence of an on-screen scientist, Dr. Barnhardt. The first mention of Barnhardt in the film comes early on, when a newspaper headline indicates that he is heading an international conference of scientists. This immediately positions him not just as a scientist but as a public figure, a point highlighted further by Barnhardt's appearance as a visual composite of the two highly visible scientists Albert Einstein and Robert Oppenheimer. Indeed, throughout the film we learn little of Barnhardt's actual contributions to research, and instead we see his ability to organize and deploy his fellow scientists in a mass meeting, akin to Oppenheimer's own contributions to the Manhattan Project as a recruitment officer and administrator.

Barnhardt's significance in the film is first detailed by Bobby, the young son of the family hosting Klaatu. During a visit to the Lincoln memorial, Klaatu admires the inscription of the Gettysburg Address and identifies Lincoln as a "great man." After his
efforts to meet with the world's heads of state have been frustrated, he suggests to Bobby that he needs to meet with a man like Lincoln, asking who the "greatest philosopher" of the era is. Bobby immediately responds that the "smartest man" alive is Dr. Barnhardt and extolls his virtues. Thus, much as Klaatu occupies an ambiguous position between diplomat and scientist, the link between Lincoln and Barnhardt cements the connection between scientists and national political leaders.

The plot of the film further reinforces the link between scientists and policy makers. After Klaatu's efforts to meet with official heads of state fails, he turns to Barnhardt for assistance in spreading his message of controlling military aggression. He convinces Barnhardt to allow him to speak at the upcoming assembly of international scientists, positioning the scientific community as an alternative locus of power in the international world. Barnhardt, for his part, has reservations about acting as a government official: "We scientists are all too often ignored or misunderstood," he says, before suggesting the expansion of the upcoming conference to include "great minds from all fields." Within the film, then, the limitations of scientists as a policy-making body are understood as a lack not of governing expertise or democratically instilled authority, but of influence. Additionally, Barnhardt's suggestion to reach out to "great minds" works simultaneously to acknowledge the importance of experts in other fields while also positioning them as subordinate to scientists. This then naturalizes a hierarchy of expertise, with scientists at the top, other educated classes below them, and ordinary citizens at the bottom.

The conclusion of The Day the Earth Stood Still leaves a degree of ambiguity in the relative merit of scientists' influence over public policy. On the one hand, the fact that
Barnhardt, and, presumably, his colleagues, embrace Klaatu's plan to work towards world peace seems an endorsement of the scientist movement and their support for international weapons control. On the other, while Klaatu delivers his final sermon to the assembled scientific conference, there is no indication that they will be any more successful in carrying out his will than he was himself. Further, Klaatu's own failure and subsequent death at the hands of the military-industrial state suggests the limited potential of any such movement.

The film's faith in scientific conscience as a check on weapons development is rendered even more ambiguously during the titular climax sequence. *The Day the Earth Stood Still* is not just an allegorical reference to the appearance of the first extraterrestrial visitor to Earth, but instead describes a scene in which Klaatu shuts down all electrical devices on Earth for twenty minutes to demonstrate the scope of his abilities. As this montage unfolds, we see a series of shots displaying the impact of this shutdown, including an automobile manufacturing plant, the milking machines on a dairy farm, a washing machine, roller coaster, and cars on a crowded city street. These displays show all aspects of contemporary life – industry, agriculture, leisure, commerce, and domestic activities – in a state of absolute paralysis. In a humorous display of abject helplessness, one woman, concerned that her telephone is inoperable, tells her husband to phone the telephone company. This scene highlights the utter dependence of a way of life on technology that operates using principles well beyond the public understanding in the postwar era. By extension, Klaatu's ability to shutdown this machinery – and thus suspend everyday life – visually highlights anxieties about the new dependence on scientific expertise. Thus, the hope that Barnhardt's international consortium of scientists
may be able to circumvent warring nation states for the sake of peace is juxtaposed against a backdrop in which ordinary people are unable to defend themselves from a technological onslaught. Any hope for scientists-as-diplomats is thus thrown into question, as their ability to shutdown atomic development goes hand-in-hand with their ability to incapacitate everyday life. Barnhardt's own sentiment, "Does all this frighten you? Does it make you feel insecure? …. I'm glad," while spoken in the name of peace, takes on a menacing air in this context.

Further, while Klaatu's position, and that of the film itself, is anti-aggression, the mechanism for restricting that aggression is curiously in line with the policies of the Strategic Air Command. When Klaatu says "We have a system, and it works," he is not referring to disarmament or voluntary self-restraint. Rather, he indicates that through automated cyborgs like Gort, alien races have maintained peace by creating an automated system of overwhelming and unstoppable retribution for any potential aggressors. This echoes of Vannevar Bush's suggestion that science would create a "world which gives a hope of peace through the fear inspired by its new weapons." Rather than being a cautionary tale about Cold War posturing or the potential follies of an arms race, this would seem to be a whole-hearted endorsement of deterrence through mutually-assured-destruction.

Ultimately, then, *The Day the Earth Stood Still* presents a tentative optimism about the new role of scientists, as the fact that their expertise is attached to a moral conscience presents an inherent check on the ability of power-mad nation states to pursue atomic warfare. However, this optimism is held in check, as it also looms as a threat over the lives of ordinary citizens. In many ways, the tension expressed in this film would be

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played out in the fate of J. Robert Oppenheimer, as the simultaneous dependence on his
expertise and fear of that very dependence would launch a trial which expressed these
tensions on the national stage.

**Oppenheimer Trial**

After Borden's letter to Hoover, President Eisenhower demanded that
Oppenheimer be removed from all atomic research projects. Bowing to political pressure,
the AEC began an investigation which culminated in the decision to suspend
Oppenheimer's security clearance. The official justification for this suspension were
Oppenheimer's past affiliations with Communists and fellow travelers, his circumvention
of security procedures, and concerns surrounding his role in advising against the
development of the hydrogen bomb. AEC Chairman Lewis Strauss offered Oppenheimer
the opportunity to resign to avoid the termination of his clearance, which Oppenheimer
declined, instead requesting a hearing of the charges against him. Oppenheimer's
clearance was then suspended pending the resolution of the hearing, which would take
place five months later in April, 1954. After hundreds of hours of testimony and dozens
of witnesses, Oppenheimer's security clearance was finally terminated on June 29, 1954 –
one day before it was slated to lapse anyway.44

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44 Almost all Oppenheimer biographies offer at least an account of the basic facts in the trial, but the
definitive text on the hearing remains Philip Stern's excellent *The Oppenheimer Case: Security on Trial*, in
which he argues that Oppenheimer's primary sin, from the perspective of the AEC, was flouting the
growing security state. Thomas Wilson's *The Great Weapons Heresy* also offers a thorough analysis of the
case, concluding that Oppenheimer's 'heresy' on the hydrogen bomb program became, by the end of the
hearing, the primary issue on which it was decided. While the position of this chapter more closely
resembles Wilson's, most of the factual information in this section comes directly from Stern. Direct quotes
from the documents of the trial, including the charge letters, witness testimony, decisions, and dissent, all
come from MIT Press' collection *In the Matter of J. Robert Oppenheimer: Transcript of Hearing Before
Personnel Security Board and Texts of Principal Documents and Letters.*
As Jessica Wang has aptly demonstrated, Oppenheimer was far from the only scientist to face loyalty or security hearings during the Cold War. However, he was one of the most publicly celebrated scientists to lose his clearance in what was undoubtedly the most widely watched and remarked upon loyalty cases of a scientist in American history. Oppenheimer's hearing and the public reaction to it offers a unique opportunity to consider not only the relationship between science and political power, but also how that relationship was understood in the popular imagination. In both his rise and fall, then, Oppenheimer's life offers an illuminating look at the emergence of government scientists as prominent public icons.

It is tempting to read the security hearings of Oppenheimer and his fellow scientists solely in the light of the anti-communist hysteria of the early 1950s. The House Un-American Activities Committee [HUAC] was very publicly in full investigative mode in the months and years leading up to Oppenheimer's hearing. The infamous Army-McCarthy hearings even overlapped with Oppenheimer's case for a few months. Communists were certainly in the public light, and Oppenheimer had no shortage of personal connections to communist and leftist organizations lurking in his past: by his own admission during his initial security clearance, he had been "a member of just about every Communist Front organization on the West Coast."

However, the Oppenheimer hearing with the AEC differed from the anti-communist witch-hunts led by HUAC and McCarthy in several key ways. Where HUAC's attacks on Hollywood leftists is difficult to interpret as anything but a crackdown on the ideological opposition, there are some obvious reasons to be concerned

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about security when it comes to high-ranking individuals with access to nuclear secrets. More significantly, the AEC's final ruling against Oppenheimer ultimately had very little to do with communism, despite the tone of the Borden letter which instigated the case. While anti-communist rhetoric might have sparked the fire, it was Oppenheimer's leadership role in the scientific community, his use of that role in opposition to the hydrogen bomb, and his occasional resistance to security mandates that ultimately decided his case.

Some critics have also suggested that the Oppenheimer hearings were influenced by personal vendettas, which was certainly a component. Oppenheimer had longstanding conflicts with the new chairman of the AEC Lewis Strauss, and had embarrassed him in front of Congress on at least one occasion. Similarly, fellow physicist and Manhattan Project alumnus Edward Teller, who became one of the key witnesses against Oppenheimer, had become increasingly frustrated with Oppenheimer's opposition to the hydrogen bomb project Teller headed. However, while these conflicts and Oppenheimer's sometimes acerbic personality undoubtedly had an impact on the hearing, they cannot fully explain the outcome and they do very little to address the rapid shift in public opinion towards Oppenheimer.

There were three factors at the heart of the Oppenheimer case and the public reaction to it. First, he placed his own judgment above the policies and strictures of the security state, to which, as an atomic scientist, he was a principal subject. Second, he initially opposed the development of the hydrogen bomb and continued to oppose the offensive-deterrent strategy of the Strategic Air Command [SAC]. And third, perhaps most importantly, he wielded a significant amount of influence, over his fellow scientists,
policy makers, and the public at large, in that opposition. The change in Oppenheimer's standing, then, has less to do with his pre-War political connections to communism and more to do with his political influence. Thus, the reaction to the Oppenheimer case marks a noteworthy expression of growing middlebrow concerns that, under the emergent military-industrial-scientific state, the public would not only be dependent on scientists' technical expertise, but subject to their moral and political judgments as well.

Although twenty-two of the charges leveled against Oppenheimer concerned his past affiliations with communists, the allegations were not that he was necessarily a fellow traveler or even that he had misused his access in any way. As Thomas Wilson notes, "[N]ot one of [the AEC witnesses] was qualified to testify about any of the first twenty-two of the twenty-four accusations made against Oppenheimer; and the matter of 'associations' simply did not arise in the course of their testimony. For another thing, all of them attested – voluntarily or in response to questions – to Oppenheimer's loyalty, and none doubted his discretion with classified information." Indeed, many of the witnesses, who were for the most part military officers or atomic scientists, testified that Oppenheimer took extraordinary care to secure classified material; more, in fact, than they did themselves.

Rather, to the extent that the trial did focus on Oppenheimer's connections to communism the concern of the AEC was that he had placed his own character judgments above the strictures of the security state. The most concerning incident to the AEC board was known as the "Chevalier incident." In 1942, a friend and former colleague named Haakon Chevalier had mentioned to Oppenheimer that another colleague, George

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Eltenton, had suggested that he had a way to deliver secret information on the nuclear program to the Soviet Union. Neither Eltenton nor Chevalier knew of Oppenheimer's involvement with the Manhattan Project at that time, and Oppenheimer testified (both at the AEC hearing and an earlier HUAC hearing) that he did not believe Chevalier was actually requesting that he turn over classified material. Chevalier reportedly did not press Oppenheimer for information, nor did he ever raise the Eltenton issue again.

Nevertheless, it took Oppenheimer eight months to disclose this conversation to a security officer and he initially withheld Chevalier's name, fabricating a story that Eltenton had instead approached "three colleagues." Four months later, under pressure from security officers to reveal who the intermediaries had been, Oppenheimer broke down and gave a full account including Chevalier's name. While none of the witnesses called suggested that Oppenheimer gave, or even considered giving, confidential information to Chevalier or Eltenton, the fact that he lied and withheld information from security officers was of particular concern. The AEC decision stated: "Dr. Oppenheimer has now admitted under oath that while in charge of the Los Alamos Laboratory and working on the most secret weapon development for the Government, he told Colonel Pash a fabrication of lies …. It is not clear today whether the account Dr. Oppenheimer gave to Colonel Pash in 1943 concerning the Chevalier incident or the story he told the Gray Board last month is the true version …. If Dr. Oppenheimer lied in 1943, as he now says he did, he committed the crime of knowingly making false and material statements to a Federal officer. If he lied to the Board, be committed perjury in 1954."47

Of even greater concern to the AEC than Oppenheimer's judgment in the Chevalier incident, however, were his judgments concerning the hydrogen bomb. As Philip Stern notes, it had been standard practice before the hearings for the AEC directors to consult with the General Advisory Committee [GAC], a board of atomic scientists headed by Oppenheimer, on a range of policy issues. However, "In later years, the General Advisory Committee, and more particularly, Robert Oppenheimer, were to be criticized for providing advice to the AEC that was neither asked for nor limited to technical and scientific considerations. Indeed, the AEC did consult the GAC on all important policy matters, including such nonscientific questions as the AEC's security program …. They welcomed whatever policy advice they could get from the GAC."^{48}

One of the central issues discussed in the press following the trial was whether or not it was appropriate for scientists like Oppenheimer to advise and influence policy matters: this was particularly salient in regard to the development of the hydrogen bomb.

Even during the early phases of the Manhattan Project, Oppenheimer was opposed to building the hydrogen fusion bomb, also known as the "Super," largely on technical grounds. At the time, Oppenheimer viewed fusion as a project unlikely to yield results in a timeline that would aid the war effort, and that further would divert valuable resources, especially fissile material, from more feasible fission research. Following the war, Oppenheimer continued either to oppose or offer tepid support for a program to develop the hydrogen bomb. It is tempting from a contemporary standpoint to read this as a moral opposition to mass destruction, particularly considering Oppenheimer's involvement with the FAS and his advocacy for international arms control. However, this interpretation may be something of an anachronism. In his advisory capacity to the AEC,
Oppenheimer continued to support research into atomic weapons throughout his career, and was hardly considered a conscientious objector by the political and military establishments. For example, as fellow GAC member Walter G. Whitman testified at Oppenheimer's AEC hearing, "I should say that always Dr. Oppenheimer was trying to point out the wide variety of military uses for the bomb, the small bomb as well as the large bomb .... [H]e more than any other man served to educate the military to the potentialities of the atomic weapon."49 Thus, regardless of whatever internal moral difficulties Oppenheimer may have faced, he supported atomic weapons research in general throughout his tenure at the AEC.

Rather, his opposition to the hydrogen bomb stemmed from two sources. First, he continued to maintain that rapid development of the Super was beyond current scientific capabilities through the late 1940s. This, of course, was a purely technical judgment and one that was certainly within the bounds of his position on the GAC to make, regardless of whether or not he was ultimately correct. Second, he argued that it would be against US strategic interests to build the hydrogen bomb even if it were possible. It was this latter plank of his argument that, as a strategic concern rather than a technical one, would work against him at the hearings as well as garner a good deal of public criticism.

The concern over strategic interests was two-fold. First, Oppenheimer saw little value to the US Cold War effort in having the hydrogen bomb, as there were few Soviet targets that would merit a weapon of that size. The 500 kiloton fission bombs already in use were large enough to decimate any Soviet military targets and even most civilian sites, apart from Moscow and St. Petersburg. Thus, in Oppenheimer's estimation, diverting energies from other more applicable research would be a misuse of resources.

49 United States Atomic Energy Commission 497.
More importantly, US tests of hydrogen bombs would be likely to speed up the Soviet's own hydrogen program, or even initiate one if it did not already exist. Oppenheimer was hardly alone in either of these views in the scientific community. As Vannevar Bush argued during the AEC hearing:

I think it is fully evident that the hydrogen bomb was of great value to Russia – much greater value to Russia than to us. I think I can also be sure that a test by us of a hydrogen bomb would be of advantage to Russia in the prosecution of their nuclear program ... because when we reviewed the evidence of the first Russian atomic explosion, we did not find out merely that they had made a bomb. We obtained a considerable amount of evidence as to the type of bomb, and the way in which it was made. If they had no other evidence than that from their own test and the like, they would have derived information.50

However, while Oppenheimer might not have been alone in his opposition, he nevertheless managed to rankle the feathers of both Edward Teller, his former student, and well-placed figures in the SAC. The SAC were the primary architects of the deterrence-via-overwhelming-force strategy employed throughout the Cold War, and the hydrogen bomb was the next logical step in that strategy. Thus, while the technical expertise of Oppenheimer and the GAC were necessary in developing new weapons, the question was whether or not their strategic concerns should have any weight against those of the political and military leaders engineering Cold War policy. Oppenheimer's resistance, such as it was, was in offering both technical and strategic advice to the AEC and his fellow atomic scientists. However, given Oppenheimer's prestige, particularly

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50 United States Atomic Energy Commission 563-564.
within the atomic science community, this advice carried a significant weight and likely discouraged a number of researchers from devoting their attention to the Super.

As Teller would later testify at the AEC hearing, "It is my belief that if at the end of the war some people like Dr. Oppenheimer would have lent moral support, not even their own work – just moral support – to work on the thermonuclear gadget, I think we could have kept at least as many people in Los Alamos as we then recruited in 1949 under very difficult conditions. I therefore believe that if we had gone to work in 1945, we could have achieved the thermonuclear bomb just about 4 years earlier." While Teller's projection that the project been completed at the same pace, despite significant advancement in atomic research and weapons development in the interim, is highly questionable, he was undoubtedly right that had Oppenheimer enthusiastically lent support to the project in 1945, it would have in all likelihood been completed earlier.

However, beyond his advice against the program, Oppenheimer never attempted to subvert or prevent the Super. After Truman ordered a crash program for the hydrogen bomb in 1949, Oppenheimer and the GAC dutifully provided administrative support and technical advice on the program. None of the witnesses at Oppenheimer's trial testified that his actions concerning the Super were in any way treasonous or insubordinate. Rather, the views of AEC board and many of Oppenheimer's detractors in the public debate that followed the hearing were perhaps best summed up by Edward Teller's testimony:

Q: To simplify the issues here, perhaps, let me ask you this question: Is it your intention in anything that you are about to testify to, to suggest that Dr. Oppenheimer is disloyal to the United States?

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51 United States Atomic Energy Commission 714.
A: I do not want to suggest anything of the kind. I know Oppenheimer as an intellectually most alert and a very complicated person, and I think it would be presumptuous and wrong on my part if I would try in any way to analyze his motives. But I have always assumed, and I now assume that he is loyal to the United States. I believe this and I shall believe it until I see very conclusive proof to the opposite.

Q: Now, a question which is the corollary of that. Do you or do you not believe that Dr. Oppenheimer is a security risk?

A: In a great number of cases I have seen Dr. Oppenheimer act – I understood that Dr. Oppenheimer acted – in a way which for me was exceedingly hard to understand. I thoroughly disagreed with him in numerous issues and his actions frankly appeared to me confused and complicated. To this extent I feel that I would like to see the vital interests of this country in hands which I understand better, and therefore trust more.⁵²

Thus, even Teller's testimony – the most damning of all the AEC witnesses to be called – stopped far short of insinuating that Oppenheimer was disloyal in any way. Rather, what was at stake was whether or not his judgments on strategic matters were in line with what Teller could "understand" and thus "trust." Given Oppenheimer's influential position on the GAC, of course, his opinions on strategy held a great deal of sway; again, it is quite likely that his opposition to the Super crash program delayed US development of the hydrogen bomb to some degree, albeit probably less than Teller estimated. For a scientist who was neither an elected politician nor a military official to

⁵² United States Atomic Energy Commission 710.
have that kind of impact meant that at least some scientists' individual judgments now had significant weight in national policy.

As the details of the Oppenheimer case became public, newspapers and magazines exploded in reaction. As only Oppenheimer's side of the story was available at first, the initial response largely treated his case as the latest extension of HUAC-style anticommunism gone awry. Reactions in the press, particularly those from scientists, feared a crackdown on scientific independence. Although some publications suggested that judgment should be reserved until more information was available, the general sentiment was that a political crusade had claimed a national hero, and that he was being convicted of "guilt-by-association."

However, after the release of the full transcript of the hearings by the AEC, public opinion began to shift against Oppenheimer. Several newspapers suggested that the outcome was fair, as Oppenheimer was "clearly guilty of arbitrariness and deceit." Some lamented the decision as unfortunate but necessary in the face of an enemy, in the words of the New York Herald Tribune editorial staff, "as implacable as resourceful, adopting every means of infiltration and subversion, taking advantage of the smallest carelessness or weakness to work its fatal poison." But many were more clearly zealous in the expulsion of Oppenheimer from the public body, believing that he "flouted restrictions set up to keep the Communist empire from getting scientific data … he willfully broke the rules – broke them with assurance, even with arrogance, as if they were not made for the special breed of which he is a member."

An editorial in *Time* magazine, a publication which had previously covered Oppenheimer quite favorably, captured much of the hostility against Oppenheimer, reading in part:

"[T]he board's dictum that a scientist's advice should be 'uncolored and uninfluenced by considerations of an emotional character' suggested that scientific advisers should act and move in a political and moral vacuum – when, in fact, scientists should be among the first to understand the ideological struggle that demands their diligent research on weapons. If, on the other hand, the board meant that no scientific expert should be allowed to give a scientific veto to such a vital project as the H-bomb, simply because he has political misgivings about it, then the board was right, for a scientific adviser cannot usurp the power of decision that rightfully belongs to the nation's political leaders."\(^{56}\)

While this editorial can be read as a kind of basic hypocrisy – moral judgments are important grounds for scientists to act from, but only if those judgments are in alignment with national policy – what is of particular interest here is that the writer betrays an underlying anxiety about the role of scientists in the Cold War. The concern expressed is about power and who can properly wield it. It is not just that Oppenheimer might have acted outside the bounds of his official capacity, but that one individual could give a "scientific veto" to a national priority. Oppenheimer, of course, never made an attempt, much less was he in the position to, "usurp the power" of national leaders. However, the ability to build and improve these new weapons rested in the minds of just a few of individuals, most of whom had close relationships with Oppenheimer. Thus, as

reactionary as the editorial might appear, it was not entirely out of line to imagine that the ever growing dependence of the nation on scientific labor, was, indeed, concentrating power in certain hands.

On the other hand, Oppenheimer's supporters frequently highlighted the question of personal liberty and the capacity for individual conscience. One insightful letter noted that "The board has made it clear that their decision cannot be regarded as 'anti-science.' But they have made it equally clear that their decision is 'anti-individual.' In demanding that the individual relinquish responsibility for his actions, the decision should be regarded as 'anti-religion.' It is drawing a thin line to grant 'the right to express . . . deep moral conviction' and 'the privilege of voicing . . . deepest doubts,' but to deny 'emotional involvement.' The privilege to express and voice is surely an empty one, if the privilege to act is withheld." Of course, Oppenheimer was not censored in the traditional sense of the word: the "privilege to act" that he was being denied was limited to his work on classified research with the AEC. But in a world where theoretical physics, particularly the areas of nuclear and quantum physics where Oppenheimer made his major contributions, was increasingly dependent on access to classified information and extraordinarily expensive equipment like cyclotrons and particle accelerators, that meant he was severely limited in the scope of his work.

At least one major scientist, Albert Einstein, agreed with the assessment that the shifting relationships between scientists and the state had dire implications for scientific independence. In a letter to the Reporter, he wrote: "If I would be a young man again and had to decide how to make my living, I would not try to become a scientist or scholar or

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teacher. I would rather choose to be a plumber or a peddler in the hope to find that modest degree of independence still available under present circumstances.”

Dr. Strangelove

The resolution of the Oppenheimer trial and the subsequent public backlash represented a significant chill in popular attitudes about scientists as wielders of political influence. This can be seen most clearly in contrasting The Day the Earth Stood Still with another critically acclaimed film released just over a decade later in 1964: Dr. Strangelove, or, How I Learned to Stop Worrying and Love the Bomb. Whereas the former expressed a cautious optimism about the strengthened public role of scientists in the Cold War order, the latter took those underlying anxieties and put them on full display. Kubrick's dark comedy took Cold War culture and turned it on its head, reveling in the absurdities of the pervasive political paranoia of the era and complacency with which the contemporary political establishment addressed deadly technologies. If Klaatu and Dr. Barnhardt represented the neutered hopes for scientific wisdom to serve as a guiding political force, Dr. Strangelove embodied the fear of scientists-come-policy-makers detached from human emotion and pushing technological achievement to its deadliest extremes.

The film's plot plays out across three interlocking storylines. In the first, General Jack Ripper, the commanding officer of an SAC base charged with nuclear response, independently initiates a nuclear bombing mission against the USSR. The second setting is the "War Room," where US President Merklin Muffley and the Joint Chiefs of Staff try to countermand General Ripper's orders or otherwise stop the bombing. And the last

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focuses on the crew of a single B-52 dispatched by General Ripper who are ultimately successful in detonating a hydrogen bomb over their Soviet target.

After a brief disclaimer that the Air Force has assured the filmmakers that the subsequent scenario is impossible under current protocols, *Dr. Strangelove* opens with a voice over narration stating "For more than a year, ominous rumors have been privately circulating among high level western leaders, that the Soviet Union had been at work on what was darkly hinted to be the ultimate weapon, a doomsday device." Viewers in 1964, of course, were well aware of another ultimate weapon, the hydrogen bomb, which had already been independently developed by both the United States and the Soviet Union. With the mutual assured destruction Cold War policy in place, the stockpile of hydrogen weapons on both sides of the conflict was functionally equivalent to any doomsday device, in that any nuclear war would result in death for all sides.

After a brief scene of two aircraft engaged in a midair refueling maneuver, we are treated to a low angle shot of radar dishes reminiscent of the opening scene from *The Day the Earth Stood Still*. Much as in the earlier film, this works to call our attention to the tremendous significance of recent technological innovations to military conflict. Unlike *The Day the Earth Stood Still*, however, this shot is juxtaposed with a cut to an air force base displaying the motto of the SAC, "Peace is our Profession." Additionally, the refueling scene, set to Vera Lynn's instrumental arrangement of "Try a Little Tenderness," is highly sexually suggestive, establishing a motif that continues throughout the film, blurring the themes of technology, sex, and death. 59 By positioning the technologies of

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war against this ironic backdrop from the outset, Kubrick immediately puts any notion of the benevolence of technological progress under a cloud of suspicion.

The use of visual montage to highlight the scope of technological dependence in *Dr. Strangelove* is similarly reminiscent of the titular sequence from *The Day the Earth Stood Still*. Throughout the scenes following the B-52 cockpit, we are repeatedly presented with a call-and-response pattern between an auditory announcement of a particular device ("CRM-114," "Backup circuits," etc.) followed by a closeup shot of the named object, demanding attention for the artifact itself. An encryption device literally cuts off Commander Kong's crew from communicating with the outside world, and General Ripper's confiscation of all personal radios has the same effect on the men at his base. The film thus calls attention to the entire system of technological automation that inevitably leads to the apocalyptic outcome.

Curiously, despite being the titular character, Dr. Strangelove – the only clearly identified scientist on screen – does not appear until just after the midway point of the film. Additionally, he appears only in two brief scenes, each consisting primarily of a dialogue with President Muffley. However, the outlandish nature of Peter Sellers' performance as Strangelove makes these brief scenes some of the most memorable in the film. Strangelove is an ex-Nazi scientist (né "Merkwuerdigliebe") which, in connection to his well-placed station in US military research, is an obvious send-up of Wernher Von Braun, the high-ranking Nazi scientist who originally headed the German V-2 missile project during World War II and was central to US rocket research (both military ICBMs and later civilian rockets under NASA) afterwards.
Additionally, the fact that Sellers was cast in several roles points to the larger significance of Dr. Strangelove as a character. While this casting decision was initially made as a reluctant concession to the studio, the end result is that these characters are intrinsically linked. In addition to Strangelove, Sellers also plays both Colonel Mandrake and President Muffley (which means that most of Strangelove's dialogue is actually Sellers having a conversation with himself in shot-reverse-shot), and had been scheduled to play Major "King" Kong, before he was injured during filming. Mandrake is a center-right British airforce officer who cautiously agrees to General Ripper's orders to use nuclear weapons when he believes the Russians have already attacked. President Muffley, modeled both visually and in personality after Adlai Stevenson, is a liberal egghead who refuses to deploy a nuclear first strike because of how he would appear in history books. And Kong is a dedicated Cold Warrior, commander of a B-52 who literally rides a hydrogen bomb to its target at the climax of the film.

Having a single actor play all of these roles collapses the distinctions between their functions. In the body of Dr. Strangelove, then, scientists, politicians, and the military are shown baring a single face. By illustrating that they are all part of a singular system, the film works directly to undercut the notion of the scientist as a conscientious objector. This satirizes the scientists' movement and the FAS, rendering laughable the idea that someone could build these weapons and then oppose their use or proliferation. In contrast with The Day the Earth Stood Still, where Dr. Barnhardt and his fellow scientists are a peaceful alternative to military-political power, Dr. Strangelove is entirely part-and-parcel of the military-industrial state.
Further, Strangelove has a privileged position within this order. President Muffley meets his military advisors, represented primarily in General Turgidson, with a significant dose of skepticism, and they are ultimately portrayed as buffoonish. The president is himself ineffectual and weak-willed. Strangelove, on the other hand, is accepted with an air of authority even when his advice, and increasingly his behavior, becomes wildly outlandish. In the closing segment of the film, he describes his solution for weathering the radioactive fallout from the Russian doomsday device. His plan involves relocating a portion of the population to the bottom of several mine shafts and creating a new social structure centered on polygamous relationships. Strangelove is illuminated with the remainder of the president's advisors in shadow behind him, and he becomes physically erratic, evidently losing control of one of his hands, which flies up in a Nazi salute. Even as he describes this nightmarish scenario, both the military and political leadership look to him to ask clarifying questions in all seriousness. Whereas earlier in the film Muffley treats Turgidson's missteps with contempt, as Strangelove carries on, Muffley leans in to ask a series of questions. He listens earnestly to Strangelove's responses, evidently giving them full credence. At the conclusion of his explanation, the Russian ambassador proclaims "I must confess, you have an astonishingly good idea there, Doctor." The nonchalance with which Strangelove greets the apparent end of all life on Earth is matched only by the ease with which the others accept his suggestions. This relaxed demeanor is contrasted against the gravity and horror of the situation, highlighted when Muffley, still relatively undisturbed, delivers his final line of the film: "Wouldn't this nucleus of survivors be so grief-stricken and anguish that they'd, well, envy the dead and not want to go on living?"
Dr. Strangelove thus begs the viewer to consider a world where scientific capability is detached from sentiment or ethical considerations. Strangelove himself serves as a purely technical advisor, without any serious regard for the human impact of his contributions – or, for that matter, of his past involvement with the Third Reich. Ultimately, then, the film's dark satire condemns the security state which would insist that a scientist like Oppenheimer separate his technical advice from his moral concerns. However, in marked contrast to The Day the Earth Stood Still, Kubrick's vision offers no suggestion that scientists may themselves intercede to mitigate the potentially catastrophic impacts of technological development. Rather, the intimate alliances between science and the state can only lead inexorably to apocalyptic outcomes.

Conclusion

The changing relationship between science and the federal government during the early Cold War represented much more than just increased expenditures or even the creation of large state bureaucracies to manage those investments. Rather, it meant two fundamental shifts. The first was largely internal to the scientific world. With the state as the primary patron of scientific research, rather than private industry or philanthropic foundations, US scientists had access to much more stable and greatly increased resources. In exchange for this, they sacrificed some of their intellectual independence and accepted a degree of government oversight and public scrutiny of their work. While the merits of this exchange are still debated within the scientific community itself, that debate rarely spilled over into public discourse or popular culture at large.

Instead, it was the second fundamental shift that concerned the public. The
integration of the scientific community into the state bureaucracies meant that some portion of state power now necessarily rested in their hands. While the public had already expressed concerns about appointed technocratic managers under the New Deal, the new research organizations meant the creation of a permanent, stable government seat for the scientific community. In many cases, the nature of their work, and even the identity of the individuals involved, was opaque to the public. The ability of these relative strangers to shape public life without democratic input caused a great deal of public anxiety. This anxiety was manifested not only in the portrayal of mad scientists bent on conquest, but in the visions of cold, technological automation which proceeds without human thought or influence. One of the earliest and most chilling of these visions appeared in Dr. Strangelove, where technological bureaucracy leads directly to the end of all human life— not by accident or misstep, but precisely according to the manner in which it was designed.

However, in a few instances, these new government scientists were able to transcend their identity as researchers. In the early years after the war, Oppenheimer was able to capture the public's imagination not just as an atomic researcher, but as a family man with a wide range of interests. He was not only praised as a hero, but his position enabled him to express political views on moderation in the Cold War that might have been anathema to another public figure. It was this image of a scientist, as a well-rounded individual and bold explorer, that would help NASA captivate the public's attention in the years to come.

As Oppenheimer's trial reveals, though, this was a fine line to walk in the public eye. While scientific expertise was essential to the Cold War security state, it was also
this expertise that raised concerns about their proper place in the political order.

Likewise, while it was Oppenheimer's ability to exceed his capacity as a technical advisor that initially warmed public opinion to him, it was this same ability that would condemn him in the public view when it was at odds with the perceived demands of national security. What the state research agencies meant, then, was that scientists had a tenuous seat at the government table, but it was a seat that required them to continually earn the public trust.
Chapter 2: NASA, Astronaut Mythologies, and the "Science Factual"

The National Aeronautics and Space Administration [NASA] was barely in its infancy in May 1961 when John F. Kennedy publicly called for it to complete one of the most dramatic scientific and technological achievements of the century – landing a man on the moon and returning him safely to Earth. The space agency had only been created three years earlier, and it spent much of its early years playing catchup to achievements by Soviet space scientists. Taking the lead in manned spaceflight required not only significant scientific and engineering breakthroughs, as well as monumental commitments in federal funding, but also capturing the American public's imagination and instilling an enthusiasm for spaceflight unlike that for any other scientific project in American history.

NASA's Mercury, Gemini, and Apollo missions were able to inspire this exuberance by appealing to a number of distinct – and sometimes seemingly divergent – interests. Space exploration was variously positioned as a matter of national pride, an essential component of national defense, a project for international peace and cooperation, a short-term means to create jobs, a long-term investment in the economy, a source for exciting new consumer goods and luxuries, and as a general boon to American science. And, of course, there was Kennedy's own nebulous explanation that "Many years ago the great British explorer George Mallory, who was to die on Mount Everest, was asked why did he want to climb it. He said, 'Because it is there.' Well, space is there, and we're going to climb it." Kennedy pitched space travel as an adventure for its own sake,

as part of a long history of American frontier narratives. Thus, a single idea – manned spaceflight – was adapted to meet a variety of imaginative needs.

Nowhere was this presentation of multifaceted and sometimes contradictory meaning more visible than in the bodies of the astronauts themselves. Astronauts in the 1960s were alternately the living manifestation of virile masculinity and Puritanical sexual restraint. While they were celebrated as bold, individualistic frontiersman in one minute, in the next popular media displayed a fascination bordering on the obsessive with their families and domestic lives, from what they ate for dinner to their wives' fashion choices. They were ostensibly on peaceful missions to conduct scientific research, and yet nearly to a man they had strong, often lifelong, connections to US military agencies. Finally, they were celebrated both for their elite backgrounds and training, as the best of the best America had to offer, while at the same time the fixation on the quotidian aspects of their lives in space, including elements of basic hygiene, framed them as "everymen," just like the rest of us in their basic needs.

Certainly, there is something to be said for space travel as a spectacular event to inspire the imagination in its own right: a human being strapped to a rocket propelled by a cataclysmic explosion of flame and noise delivering millions of pounds of thrust as it lifts to previously unexplored heights is a striking moment to witness. However, the particular imaginative connections to the NASA space programs in the 1960s were not necessarily a given. For example, while the massive expenditures through NASA lent significant prestige to space scientists, a large portion of the scientific community argued that NASA's particular emphasis on manned spaceflight was of little scientific utility. Likewise, spending through NASA certainly helped create jobs, particularly near its
major centers of operation in Houston and the "space coast" in Florida, but it also meant that the massive public funds dedicated to the project could not be allocated to more direct anti-poverty programs. Thus, at times these meanings were contested – the question of poverty in particular would drive significant criticism of NASA later in the 1960s – and these could hardly be described as unmediated responses to space travel.

Rather, the varied interpretations of manned space exploration were the result of concerted efforts from a variety of actors, both public and private, not the least of which were the public relations activities of NASA itself. As James Kauffman has noted, "One typically thinks of NASA as an agency concerned with science and technology, not with public image making. Yet in the early 1960s, the agency labored long and hard to create a positive image of its programs, its flights, and its astronauts. All along, however, it denied doing so. In short, part of the perception of NASA as a scientific, technological agency that was above manipulating public perception comes from the agency itself." As an institution born of a public relations race with the Soviet Union and dependent on public support for its continued funding, NASA lobbied members of Congress, developed extensive relationships with the press, and worked to educate the public about the potential benefits of space travel.

But NASA was hardly alone in this endeavor. Private defense contractors lobbying for continued support, news media hungry for exciting stories and high adventure, scientists eager for federal grants, artists and filmmakers dreaming of new worlds, and amateur space enthusiasts all contributed to the mythology of manned space exploration. Sometimes, alliances between these groups were explicit, as with Wernher

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von Braun's collaboration with Walt Disney on animated educational films or the contractual relationship between the Mercury astronauts and *Life* magazine. At other times, efforts were independent and sometimes even worked at cross-purposes, such as when Kennedy's call for a joint lunar mission with the Soviets angered Congressional members who saw the space race as an extension of the Cold War.

Creating these versatile structures of feeling about space travel often required blurring the line between science fact and fantasy in the process. In the effort to pitch spaceflight to the American public, space enthusiasts – both within and outside NASA's official channels – often drew little distinction between what had already been achieved, what was immediately possible with existing technology, what was reasonably projected in the long-term, and more wild speculation about the future. Thus, a science fiction film like *2001: A Space Odyssey* would make meticulous, and expensive, efforts to accurately represent physical details of life in space, while NASA would draw on the utopic imagination of space colonization at work in *Star Trek* to pitch its own very real programs. This, of course, had long been the dominant mode employed in science fiction, but rarely had a collaboration at the imaginative level between scientists, science policy makers, and the cultural agents of science fiction been more productive: these diffuse and sometimes disparate efforts ultimately worked to create the broad matrix of meanings necessary to create and maintain support for the largest peacetime public works project in US history.
Imagining Space

A fascination with traveling through the heavens predates not only the Apollo era, but American history at large. Indeed, the lunar program itself was named after the ancient Greek god who rode his chariot across the sky each day, hinting at its ancient imaginative roots. At least as early as the eighteenth century, fantasies of travel to the moon appeared in fiction. In the nineteenth century, Jules Verne's wildly popular From the Earth to the Moon (1865) centered on a voyage to the moon powered by a cannon. This in turn inspired not only H.G. Wells The First Men in the Moon (1901), but also George Melies' film A Trip to the Moon (1902), the first science fiction film and the source of many groundbreaking advances in film technology and special effects. Partly in response to Verne's work, Konstantin Tsiolkovsky published the first serious scientific theory of rocket propelled space travel in 1903, though his work was little known outside of Russia in his own era. Even at this early stage, Tsiolkovsky wedded the idea of spaceflight to the solution for earthbound problems, believing that space travel would lead to the metaphysical evolution of humankind.62

But no one would so successfully weld the fantasy of spaceflight to the practical application of rocketry as Wernher von Braun. Born in Germany in 1912, von Braun did not excel in science or mathematics in his early years. As a young boy, however, he was fascinated by the science fiction of Jules Verne, particularly his stories of travel through outer space. As he approached university age, he was profoundly influenced by the publication of German rocket pioneer Hermann Oberth's By Rocket into Interplanetary Space (1929), and thereafter dedicated himself to the study of rocketry. He would later

work with Oberth at the Technical University of Berlin, where both were members of the Verein für Raumschiffahrt ("Spaceflight Society"). Von Braun would credit Oberth as one of his foremost inspirations throughout the rest of his life.⁶³

While it may have been dreams of space travel that turned von Braun's interests towards rocketry, his early work in Germany had decidedly more terrestrial targets. Von Braun was still completing his doctoral research when the elections of July 1932 established the National Socialist German Workers' Party as the largest faction in parliament and a young man by the name of Adolf Hitler was appointed Chancellor. Rocketry immediately became a part of the national agenda, and by October of the same year von Braun began development of the Aggregat series of rockets under the German Army missile program.⁶⁴ His work on the A-1 and A-2 rockets was central to his doctoral thesis, which he completed in 1934, though since much of this was classified at the time he also published a public thesis titled "About Combustion Tests," which outlined some of the theoretical advancements underlying the rockets.⁶⁵ He would continue his work on the Aggregat series over the next decade. The A-4 rocket, the height of von Braun's achievements in Germany, became much more famously known under its alternate designation, the V-2.

Von Braun first proposed the A-4 in 1936 and laid out the technical specifications in 1937. What he proposed was the pinnacle of mid-century rocket science, both a true

⁶⁴ Neufeld.
⁶⁵ Ward 19.
marvel of the modern era and a crude tool of indiscriminate death. The rocket designed by von Braun was forty-six feet tall, weighed fourteen tons, and was propelled by a mix of alcohol and liquid oxygen. The vehicle could strike a target from a distance of 200 miles away, traveling to its destination at a maximum speed of over 3,000 miles per hour, all while carrying a warhead weighing up to a metric ton. Unlike conventional bombers, the A-4 did not require a pilot, and its supersonic speeds meant there was little warning before a strike – a rocket could reach London in approximately three minutes – so that conventional antiair defenses were useless. In short, it was a super weapon.

As a product of the cutting edge of the relatively nascent science in rocketry, however, the A-4 was also incredibly expensive and there were significant delays in its development. Despite von Braun's designs in 1937, functioning V-2s were not actively deployed until September 1944, far too late to have a significant impact on the outcome of the war. The futility of deploying the weapons that late, however, did not stop the German military from firing hundreds of rockets at London and Antwerp, killing thousands of civilians in the process. The number of civilian deaths would undoubtedly have been higher still if not for a clever ploy by British intelligence that leaked false information indicating the first rockets had missed their mark, causing German rocketeers to overcorrect subsequent trajectories. A single V-2 strike in Antwerp, the deadliest of the war, killed over 500 people when a crowded theater collapsed.

More troubling to some of von Braun's critics after the war than the deaths caused by the detonation of his rockets, however, were those caused by their construction. Von Braun and his research team had worked primarily out of a site at Peenemünde, but following a raid in 1943 by the British Royal Air Force, much of the mass production of

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V-2 rockets took place at Mittelwerk, which drew much of its labor from the Mittelbrau-Dora concentration camp. Both Peenemünde and Mittelwerk relied on slave labor. By the end of the war, over 20,000 workers at Dora, nearly a third of those assigned to the site, died during construction from exhaustion, hanging, disease and starvation. This represented many times more deaths than those caused by the actual deployment of rockets.

There remains significant debate about the extent to which von Braun was complicit, or even aware of, many of the atrocities committed on behalf of completing his rocket designs. He had been a member of the Nazi party and an officer of the SS at least as early as 1937. However, anyone in a similar position working on highly classified subjects who refused to join the party would likely have had to end their research, if not face imprisonment or execution. Certainly, he was familiar with the Russian POW forced labor at Peenemünde and had witnessed some of the conditions at Mittelwerk firsthand, although he may have been sheltered from some of the more horrific conditions at Dora. It is also unlikely that he could have objected to the practice without facing harsh punishment himself – the orders concerning the use of forced labor came directly from Himmler, who greatly outranked von Braun and had virtually absolute control over the project. However, after the war several Dora survivors and family members would allege that not only was von Braun aware of the abuses at Dora, but that on a few occasions he participated in whipping and flogging workers. For his part, Michael J. Neufeld, one of the leading biographers of von Braun, concedes that von Braun was

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67 Neufeld.
68 Biddle.
likely powerless to end the abuses, but suggests that he still had a moral obligation to object to the conditions, which he failed to do.

At least one thing can be said for certain about von Braun's work on the German V-2: he was able to make significant progress towards one of his life's goals in advancing the potential for rockets as a means of space travel. After the war was over, von Braun would claim that working for the German army had been the only means available at the time to pursue this goal, writing "Any moral conflict caused by the thought the rockets could be used as weapons in a war was opposed by the desire for finance for our space plans. We always considered the development of rockets for military purposes as a roundabout way to get into space." The V-2 did indeed become the first man-made object to reach outer space. Further, it became the basic model on which both US and Soviet engineers built all their early rockets in the postwar era, both for space exploration and intercontinental ballistic missiles after they reverse engineered V-2s captured at the war's end. The US would have the benefit of von Braun himself in addition to his rockets.

It became apparent to the rocket teams at Peenemünde by early 1945 that Germany's occupation by Allied forces was imminent. After consulting with one another, von Braun and his team members decided that it would be best to be captured by the Americans. He later called this a "moral decision," citing democracy as the system most likely to exercise restraint in the use of the weapons he was providing, although at the time the harsh treatment they had heard about in Soviet prisoner-of-war camps likely weighed heavily on their minds. After a chaotic journey involving forged documents, assassination orders, and narrow escapes seemingly pulled straight from the latest

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69 As quoted in Ward 52.
70 Ward 53.
Hollywood espionage thriller, von Braun succeeded in turning himself over to the Americans.

He was transported, along with trainloads of V-2 parts, to the United States later that year, under "Operation Paperclip." By the end of 1945, von Braun was advising US Army personnel on long range rocket development construction based on his expertise with the V-2. He continued to develop rockets for the Army throughout the early Cold War, and went on to lead researchers at the Army Ballistic Missile Agency from 1950-1956 in developing the Redstone Rocket, the first missile capable of delivering nuclear warheads to Russia from West Germany. It was during this same time that he began a consistent effort to raise the popularity of rocket-driven space travel with the US public.

Through a series of newspaper columns, public talks and symposiums, magazine articles, and full-length texts, von Braun attempted to convey that space travel was not necessarily limited to pulp science fiction serials: it was possible in the immediate future. The most notable of these efforts came in a series of articles titled "Man Will Conquer Space Soon!" for Collier's Weekly magazine from 1952 to 1954. Edited by Irish journalist Cornelius Ryan, the series was composed of individual articles written by von Braun and fellow rocket scientists such as Willy Ley and Fred Whipple who shared his enthusiasm for space travel. Von Braun and his collaborators expanded the articles into three popular books published through Viking Press, reaching an even wider audience.71 While some of the early articles were explanations for a popular audience of the basic principles of rocketry or the research and engineering work already completed or underway by von

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Braun and his colleagues, later entries were more speculative in nature. This was particularly true of the final entries on the exploration of Mars, a voyage that was well beyond the engineering capabilities of the era.

To help *Collier's* readers visualize their proposals, Von Braun invited Chesley Bonestell to provide a series of illustrations to accompany the articles. Bonestell had previously collaborated with Willy Ley on his book *The Conquest of Space* and was a leading science fiction illustrator of the era. The *Collier's* illustrations were of both the proposed spacecraft and the extraterrestrial terrain the astronauts would be traversing, delivering the visually stimulating imaginary of space travel to the doors and newsstands of middlebrow readers. Bonestell's lush, full-color illustrations of Von Braun's spaceships, positioned against photorealistic paintings of moonscapes and Martian plains, stitched together a sense of the fantastic with a realist aesthetic. The impression of scientific authenticity was further strengthened by the illustrations' appearance adjacent to the detailed explanations by real rocket scientists such as Von Braun, Ley, and Whipple.

While Bonestell's name might not have been immediately familiar to *Collier's* readers, many of them were likely already familiar with his work. Not only was he frequently commissioned for science fiction magazine and book covers, but his work had also appeared in Hollywood films and popular, mainstream magazines. As Ron Miller notes,

Bonestell's space art first appeared in print in *Life* in 1944: a series of paintings showing Saturn as it would appear as seen from its various moons. Nothing like these images had ever been seen before. Bonestell had combined a highly polished technical skill with his experience as a Hollywood special effects matte

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artist to create pictures that looked more like postcards than mere 'artists's impressions.' His paintings possessed an almost intense believability that was far more important than any mere scientific facts they may have contained.\(^{73}\)

The sense of 'believability,' as Miller calls it, in Bonestell's art proved central in rendering the fantastic notion of spaceflight as an attainable reality.

Additionally, prior to his contributions to Von Braun's series in Collier's, Bonestell had worked, uncredited, as a visual and effect artist in Hollywood on a number of films, including Citizen Kane (1941). But his most significant contributions to cinema came from his science fictional collaborations with producer George Pal, previously known primarily for his work with animated puppetry. Together, Pal and Bonestell created a series of films beginning with Destination Moon (1950) which, while relying on action and adventure narratives akin to other Hollywood science fiction filmmakers of the era, strived to adhere to known scientific principles wherever possible. Preparing for the release of Destination Moon, one commenter noted "Far from portraying the more fantastic space excursions of Buck Rogers or even H.G. Wells, the studios are in step with science. By filmically combining the known scientific facts with reasonable conjuration, the movies might even be said to be prodding science along."\(^{74}\)

By characterizing Destination Moon as a "scientific film," rather than under the conventional term science fiction, the reviewer suggested a generic break from the more fantastic elements of contemporary science fiction films.

Based on a screenplay by noted science fiction author Robert Heinlein, and loosely adapted from his young adult novel Rocket Ship Galileo (1947), Destination

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\(^{73}\) Miller 142. Emphasis added.

*Moon* centers on a group of American industrialists and scientists who build and pilot a rocket to the moon. The film is rich with the technical details of space travel, including a film-within-a-film to explain the basic principles of rocketry to the audience. The narrative, such as it is, is remarkably free of the interpersonal or violent conflicts traditionally employed in adventure films, with the primary hazards and obstacles coming from the extreme nature and alien environment of outer space. The relative absence of conflict is noteworthy considering that both *Rocket Ship Galileo* and Heinlein's subsequent novella adaptation of *Destination Moon* featured the presence of an extant enemy settlement – manned by Nazis in the former and Soviets in the latter – on the moon prior to the Americans' arrival.

Nevertheless, the opening sequence establishes a military context for the mission to the moon. Following the opening credits, the film immediately cuts to a sign, occupying the entire field of vision, that reads "WARNING: CLOSED AREA. ALL TRAFFIC PROHIBITED BY ORDER OF U.S. ARMY ORDNANCE DEPT." The camera then pans across a desert landscape, broken by a vertical rocket, before cutting to two men, Dr. Charles Cargraves and General Thayer, observing the rocket test through a narrow slit in a protected bunker. The desert, observation bunker, and secret military tests are all immediately evocative of the photographs of Trinity tests at the conclusion of the Manhattan Project. After ignition, the rocket test fails, plummeting to Earth rather than achieving orbit, and the two observers quickly conclude that the only explanation is sabotage. Although the origin of these saboteurs is never revealed, it is strongly suggested that Soviets are responsible. Later, General Thayer claims "We are not the only ones who know that the moon can be reached. We are not the only ones who are planning to go
there. The race is on, and we'd better win it. Because, there is absolutely no way to stop an attack from outer space. The first country that can use the moon for the launching of missiles will control the Earth." Thus, despite the lack of direct military conflict during the course of the narrative, Destination Moon firmly embeds the endeavor within the ideology of Cold War conflict.

Despite this, the mission to the moon in the film is explicitly a private one. Following the failed rocket test in the opening, General Thayer notes that the military will have to cut funding for the rocket program. Stating "It's peace time; the government isn't making those kind of appropriations," he turns to jet engine manufacturer Jim Barnes to head the project. The two of them, in turn, recruit a group of industrialists and investors to support the project, under the assumption that the government will subsequently purchase the technology. At the meeting, one investor says to Barnes: "Now listen fella, I've known you from way back. Two engine planes weren't fast enough; you had to go in for four. Then props weren't fast enough; you had to go in for jets. Now you've got ahold of something else." As part of Barnes' reply, he notes "What's the moon? Another North Pole, another South Pole." By drawing an unbroken line from evolutions in air travel to rocketry and from recent terrestrial explorations to the moon, this sequence establishes the lunar voyage as scientifically plausible and imminently feasible.

To explain the principles of rocketry to the assembled industrialists, and presumably the film's lay audience, Barnes introduces a motion picture with "one of Hollywood's best known actors to play for you." He starts a projector, and the well-known staccato laughter of Woody Woodpecker is heard off-screen before cutting to an animated film-within-a-film. During the animated sequence, Woodpecker stands in for
the skeptical audience, repeatedly exclaiming the impossibility of a voyage to the moon, saying "Dragging me all the way down here to talk about a trip to the moon. It's ridiculous. Comic book stuff." An unseen narrator then demonstrates Newtonian motion to Woodpecker by having him fire a shotgun, pushing him in the opposite direction. The narrator then responds to each of Woodpecker's objections to a lunar voyage with reasoned explanations of how these obstacles can be overcome.

Beyond simply explaining the physics of spaceflight to an audience who may have been uneducated in the subject, the film-within-a-film accomplishes two additional objectives. First, by having Woody Woodpecker stand in as a comic foil to the omniscient narrator, the animated short frames doubt as a product of ignorance, rather than of legitimate scientific skepticism. Secondly, it adds a feeling of veracity to the rest of the film at the level of aesthetics: the cartoonish animation – including Woody Woodpecker's bodily contortions, the simplified renderings of the Earth and moon, and the illustration of gravitational fields with giant magnets – stands in marked contrast to the photorealistic effects employed later in Destination Moon. Thus, through the disparity between the animated sequence and Bonestell's matte painted moonscapes, Pal's elaborate rocket sets, or grainy, photograph-like images of Earth from outer space used later in the film, we are led to regard the latter as the realm of the real, having already relegated the former to the imaginary.

Pal went to great lengths in trying to establish a feeling of authenticity for the film. For the zero gravity sequences, he tested several photographic techniques, including filming underwater with special filters to remove the water and using traveling mattes to move the backgrounds behind the actors. Ultimately, he elected to build a giant, rotating
set for the rocket, which he told journalists was the most complex and expensive set in film history. Speaking to the *St. Petersburg Times* ahead of the film's release, Pal noted "We will be as scientifically correct as possible …. For example, we will be accurate as to how people probably would move in the 'free fall' area outside the earth's gravity pull. We couldn't have actors floating around the set so we're having the set float around the actors." He also described *Destination Moon* as a "'realistic' semi-documentary," thus clearly attempting to position the film on the "science" end of science-fiction.\(^{75}\)

Released seven years before Sputnik's launch and a full nineteen years before Apollo 11's successful mission to the moon, *Destination Moon* presaged a number of key aspects of the space race. In addition to the vague military aims and Cold War context described above, *Moon* also highlights the collaboration between science, industry, and government. After the failed launch in the opening sequence, it falls to a team of private entrepreneurs, scientists, and the military to assemble the rocket. The four men who fly to the moon are Jim Barnes, an industrialist, Dr. Charles Cargraves, a rocket scientist, General Thayer, and Joe Sweeney, a mechanic who steps in at the last minute to replace an injured engineer. The latter is marked by a thick Brooklyn accent and ignorance of the scientific principles which allow him to stand in for the "common man" and serve as a sounding board for the other characters to explain the rocket's functions and the mechanics of zero gravity environments to the lay audience. Notably, however, the reviewer for the *New York Times* explicitly identified them as "four scientists," suggesting

that, at least to some viewers, their very role as space explorers meant they were understood as scientists.\footnote{Bosley Crowther. "THE SCREEN: TWO NEW FEATURES ARRIVE" The New York Times 28 June 1950. NYTimes.com. Web. 8 Jan. 2012.}

The cast of \textit{Destination Moon} is overwhelmingly male – the four astronauts as well as almost all of the supporting cast playing scientists, engineers, military officials, and industrialists are men. In light of later developments in space narratives during the 1960s, however, it is worth noting the only scene featuring a woman in a primary speaking role. Just prior to the rocket's launch, Dr. Cargrave's wife visits him on the launchpad to kiss him goodbye and insist on his safe return. The promotional trailer for the film features this scene set against a dramatic score as the narrator exclaims "Never before has any woman sent her man on such an exploit!" It would be easy to dismiss this as a simple marketing effort to broaden the film's box office appeal, particularly given Mrs. Cargrave's almost complete absence from the rest of the script. However, this brief scene – and the particular attention paid it in the promotional materials – works to situate space travel in a specifically domestic context, establishing an intimate connection between the unexplored frontier of the moon and a feminized homefront. As we will see, this particular narrative thread would become a central feature of press coverage of NASA during the 1960s.

Additionally, similar to the \textit{Collier's} articles printed just a few years after its release, \textit{Destination Moon} positions the trip to the moon as just one element in an unbroken line of continuing expansion and exploration. As mentioned previously, Barnes' comparison of the moon to the North and South Poles, and as a destination to be conquered simply because it is there, thoroughly embeds the film in an American
mythology of discovery and territorial acquisition dating back to the exploration of the western frontier. Similarly, the film ends as the rocket is igniting for the return to Earth, with the fate of the astronauts left uncertain, before the closing text declares "This is the end... of the beginning!" While this adds a sense of dramatic tension to the ending, it also suggests that the moon is not only a destination, but a step along the way to still more exploration of the solar system, much as von Braun would repeatedly suggest that the creation of lunar or orbital space stations could serve as staging grounds for voyages to Mars.

After the release of *Destination Moon*, Bonestell and Pal worked together on three additional science fiction films, including a fictional adaptation of *Conquest of Space* (1955), based on Willy Ley's book of the same title which Bonestell had previously illustrated. While the two middle films, *The War of the Worlds* (1953) and *Cat-Women of the Moon* (1953), engaged in fanciful adventure narratives more typical of contemporary low-budget science fiction film, even these follow the overall realist aesthetic established by Bonestell's work with canvas and ink. Although literary critic Fredric Jameson would later dismiss *Destination Moon* as a 'historical curiosuty,' despite having never seen it, the fusion of the fantastic and the factual nevertheless concretized an aesthetic that would leave a lasting impact not only on Hollywood science fiction, but on middlebrow representations of space travel throughout the 1950s and 60s.

Ultimately, the *Collier's* articles by von Braun and his colleagues also served as the inspiration for a television special as part of the "Tomorrowland" segment on Walt Disney's *Disneyland* series. Between 1955 and 1957, Disney produced three episodes on spaceflight to air on ABC: "Man in Space," "Man and the Moon," and "Mars and

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Beyond." The first episode was broadcast to an estimated forty-two million viewers.\textsuperscript{78} Von Braun not only served as a technical consultant for the show, but appeared on screen to explain his rocket designs and visions for future space travel to the audience, with nary a mention of his work on the V-2 or his complicity with the atrocities in the forced labor camps. Rather, this history is whitewashed in favor of an image of the benevolent scientist, gently guiding viewers into a bold new technological era.

Disney himself provided the introduction for the first episode: "In our modern world, everywhere we look, we see the influence science has on our daily lives. Discoveries that were miracles a few short years ago are accepted as commonplace today. Many of the things that seem impossible now will become reality tomorrow."\textsuperscript{79} The episode then delivers on his promise, neatly mixing the miraculous and the impossible with reality and the commonplace. All three episodes offer segments alternating between live action footage and multiple styles of animation. The live action footage is generally of von Braun and his colleagues explaining established scientific principles to the audience using model rockets and charts. Interspersed with these are highly stylized, often comedic, presentations of myths and folklore about space, the moon, or Mars. As J.P. Telotte argues, however, the animation of von Braun's theoretical spacecraft and proposed voyages take on a different nature:

[T]he supporting animation adopts a decidedly different style and tone; it is pointedly realistic, even dramatically so, and suggests the style of famed space illustrator Chesley Bonestell, who had provided most of the illustrations for the original Collier's magazine series …. This uninterrupted sequence detailing the

\textsuperscript{78} Schenker.
\textsuperscript{79} Ward Kimball, Hamilton Luske, and Jeff Kurtti. \textit{Walt Disney Treasures - Tomorrow Land: Disney in Space and Beyond.} Walt Disney Video, 2004. Film.
preparation of a rocket, its launching into orbital flight, the conducting of various experiments in space, and the safe return to Earth is shot very much like a live-action narrative … [simulating] a number of fundamental techniques of realist cinema: a constantly tracking camera, long takes, cuts on action, and effective layering to produce a three-dimensional effect. Together with the pointedly realistic style of the images and the dramatic lighting employed throughout the sequence, these effects combine to produce a stark contrast to the earlier animated segments …. This final sequence of "Man in Space" not only convincingly visualizes what "might be accomplished," as von Braun puts it in his narration, it also effectively places viewers within this new world of heroic scientific achievement.80

This mix of the known, the probable, and the fantastic was not an accident on Disney's part. He identified his objective as combining "the tools of our trade with the knowledge of the scientists to give a factual picture of the latest plans for man's newest adventure." To promote the second film, Disney released an educational brochure claiming "This film presents a realistic and believable trip to the moon in a rocket ship - not in some far-off fantastic never-never land, but in the near foreseeable future." He would later coin the term "science factual" to describe his approach to the filmic representations of science in the "Tomorrowland" segments.81 What Disney had done, in the vein of Bonestell and Pal before him, was to draw on both the hard-nosed credibility of science and the fanciful imaginary of science fiction to present a compelling vision of achievable space exploration. More importantly, the movement between these three visual motifs – the

80 Telotte 52-53.
81 Schenker.
real, the fantastic, and the possible – seemed to deliver on Disney's promise that
"impossible now will become reality tomorrow."

Disney also turned to von Braun and his rocketeers to make the "impossible"
world of the future even more concrete and available to a middlebrow audience in the
Tomorrowland section of his new Disneyland theme park in 1955. Modeled after the
technology expositions at the World's Fairs of the twentieth century, Tomorrowland
offered visitors to the park a sensational look at emerging technologies. Features in this
section of the park included rides promoting the achievements of postwar American
science and industry, such as Autopia, which showcased the new National Interstate
Highway System. Towering over the area – and indeed, as the tallest structure in the park,
over all of Disneyland – was the TWA Moonliner. A one-third scale model based on von
Braun's design, the seventy-six foot tall rocket was intended as a projection of an atomic-
powered, civilian transport to the moon. Attached to the Moonliner was "Flight to the
Moon," a children's ride inspired by the Tomorrowland television special. The ride
featured rocket-shaped carriages attached to hydraulic lifts, rapidly accelerating
passengers up and down. Tomorrowland and the Moonliner thus not only rendered space
travel as visible and palpable to park visitors, but invited them to participate as well.

The corporate sponsorship of Tomorrowland is important to note. The last section
of the park to be built, Tomorrowland had a number of incomplete rides and features
when the park opened. To speed construction and fill space, Disney turned to corporate
exhibitions like the Monsanto Hall of Chemistry. The Moonliner was sponsored by Trans
World Airlines and Howard Hughes. As De Witt Douglas Kilgore notes, "acceptance of
that brave new world also meant embracing a future dominated by the large corporations
and government agencies that Disney and von Braun so ably represented …. Following the example of the futuristic world's fairs of the 1930s, Disney and his German-American collaborators offered a future that marshaled familiar economic and political forces.”

Disney's vision of progress, then, was a very particular one, merging scientific advances with corporate stewardship and government bureaucracy, which ultimately presaged the image offered by NASA itself.

**Sputnik**

Despite the growing public fascination with spaceflight in the 1950s, it would remain a relatively low priority for US policy makers throughout the bulk of the decade. There were two significant satellite programs in development by the end of 1956, the Army's *Explorer* project and the *Vanguard* project, a collaboration between the Navy and civilians through the NSF, both attempting to place a man-made object in orbit during the International Geophysical Year [IGY] of 1957-1958. However, neither satellite project was highly publicized or celebrated by the Eisenhower administration. Space exploration, particularly the fantastic manned lunar and Martian expeditions advocated by rocket enthusiasts like von Braun, was not seen as an important element of either foreign or domestic policy. That would change dramatically, however, on October 4th, 1957. That evening, listeners on the NBC radio network heard an announcer describe a simple, repetitive beep as "the sound that forevermore separates the old from the new."

The beep in question came from the first man-made object to orbit the Earth, the Soviet satellite Sputnik I. As Paul Dickson describes it, "The satellite was silver in color, 

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about the size of a beach ball, and weighed a mere 184 pounds. Yet for all its simplicity, small size, and inability to do more than orbit the Earth and transmit meaningless radio blips, the impact of Sputnik on the United States and the world was enormous and unprecedented.\textsuperscript{83} Carried to orbit by a modified inter-continental ballistic missile, the satellite was a bright silver sphere with four whip-like antenna that trailed behind it, broadcasting its simple pattern of beeps in all directions.

The immediate American reaction to the Soviet launch was relatively favorable – a group of US scientists, attending an international gathering as part of the IGY, congratulated and cheered for their Soviet colleagues on first hearing the news. Ham radio hobbyists around the country tracked the satellite's broadcasts, while amateur astronomers followed its progress through the night sky. For those without access to personal telescopes, the highly reflective orbiter was visible even to the naked eye under the right conditions. Viewers responded with a mix of wonder and awe at the 'new moon' made by human hands. Tens of thousands of people across the country participated in reporting data on Sputnik's flight path to local observatories to help track its orbital path.\textsuperscript{84} However, this initial wave of excitement from space enthusiasts soon gave way to fear of the country that developed it.

The launch should not have come as a complete shock. In 1955, both the United States and Soviet governments had previously announced their intention to launch man-made satellites as part of the IGY. However, it was widely assumed in the West that the US would launch the first satellite, and most eyes were on the Navy's Vanguard Project to achieve the first orbit. Initially funded by the NSF, Vanguard received priority from the

\textsuperscript{84} Dickson 9-13.
Eisenhower administration, over proposals from the Army and Air Force, with the idea that if the first orbital launch was a civilian, scientific satellite (as opposed to a military spy satellite), they were less likely to face objections from the USSR. The project received a good deal of publicity between 1955 and 1957, including scores of magazine articles and multiple books released in preparation for its launch, all of which assumed it would be the first successful satellite. A November 1956 *New York Times* article was representative in this regard when it showed readers an image of "VANGUARD – a cutaway model of the first artificial satellite," a full year before even the initial estimation of its launch.\(^8^5\) These predictions were likely due, at least in part, to the fact that the Navy was significantly more transparent than its Russian counterparts, issuing design specifications and holding regular press conferences, whereas little was known about the Sputnik project outside of the Soviet Union. However, the predictions also speak to cultural assumptions about the United States' natural role as a world leader in science, after successfully developing both atom and hydrogen bombs several years in advance of the Soviet Union.

It was in the light of this perceived superiority that the launch came as such a shock. By the launch of Sputnik 2 – which successfully carried a live canine into orbit less than a month after Sputnik 1 – the US press was in a state of distress over the capabilities of Russian rocket science. Editorial pages filled with concerns over what other payloads the Soviet missiles could deliver – and where they could deliver them. If they could carry radio transmitters into orbit, could they also carry spy satellites or, worse yet, nuclear weapons? But beyond the concerns of immediate threat, the Sputnik launches

also posed a more fundamental threat to the ideology that the American system had an infallible edge over the Soviets when it came to innovation. As Glen Scott Allen notes, "The near-hysteria which greeted Sputnik's faint beeping was if nothing else a measure of how absolutely astounded we were that any nation other than America could mount the massive mechanical and organizational effort required to enter the Space Age."  

A *Time* magazine cover story from November 18, 1957 raised the question of national priorities directly with its readers.

In the uneasy autumn of 1957, the U.S. is reluctantly grasping the full, unwelcome meaning of Russian-made metal objects orbiting around the earth. Sputnik I and Sputnik II have painfully fractured the U.S.'s contented expectation that, behind an impenetrable shield of technological superiority, the nation could go on with the pursuit of happiness and business as usual this year and the next and the next. Now the U.S. has to live with the uncomfortable realization that Russia is racing with clenched-teeth determination to surpass the West in science – and is rapidly narrowing the West's shielding lead ... Today Russia graduates more than twice as many scientists and engineers per year as the U.S. So sophisticated was the approach of Communist bosses to science – particularly since World War II – that they freed scientists from the Communist system itself, set them up in a never-never land of unlimited funds, limousines, dachas, and even – in the last few years – freedom of thought.  

The somewhat hyperbolic description of luxurious scientist lifestyles under the Soviet system was not entirely accurate, especially as dissident scientists were still regularly

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exiled to Siberian work camps. Nevertheless, a number of national publications, including the *New York Times*, the *Washington Post*, and the *Chicago Daily News*, repeated the claims.

Eisenhower, for his part, responded with relative aplomb to the situation. As historian Margot A. Henriksen notes, "Eisenhower admitted being surprised by the 'intensity of the public concern,' and he had to deal with a kind of hostility to which he had seemed immune." While he couldn't divulge the source of his calm to the public, he was well-aware that the US Air Force was close to launching its own spy satellites. His attempts to reassure the public, however, were falling flat. As Paul Dickson writes, "In general, media commentators, the public, and many on Capitol Hill found the president's response to Sputnik and his reassurances on the military significance inadequate. Doris Fleeson, a *Washington Evening Star* columnist, wrote that Eisenhower gave the satellite the 'Miltown treatment,' alluding to the Prozac of the 1950s." Thus, under mounting political pressure Eisenhower convened a meeting of the National Security Council to evaluate Sputnik's impact and possible US responses. Determined to carry forward by first launching a civilian satellite, the administration elected to accelerate the Vanguard project to place a satellite in orbit during its next scheduled launch, in December 1957. This resulted in a spectacular backfire when the missile detonated on the launch pad, after only two seconds of ignition, before the eyes of watching press crews and thousands of enthusiasts who had come to observe the takeoff. While the Army's satellite team, headed by von Braun, would succeed in placing the Explorer I in orbit just over a month later in January 1958, the US space program was still seen as lagging behind.

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88 Henriksen 105.
89 Dickson 120.
In addition to Eisenhower's domestic troubles, he was also concerned with the US image abroad. All around the world, Sputnik seemed to turn the tide of public opinion dramatically in favor of the Soviets. According to Dickson, "A Gallup poll discovered that US prestige had eroded in six of the seven foreign cities included in its survey, and within weeks there was a decline in public enthusiasm for 'siding with the US and NATO' … Radio Cairo expressed the thoughts of many in the Third World: 'The planetary era rings the death knell of colonialism; the American policy of encirclement of the Soviet Union has pitifully failed.' " Even ardent anticommunist Generalissimo Francisco Franco of Spain was making pro-Soviet remarks after Sputnik.90 Given the context of the Cold War, in which the US was competing with the USSR to demonstrate the superiority of their respective political and economic systems to win over neutral and non-aligned states, Sputnik was a major blow to US foreign policy. As Walter MacDougall notes, "Sputnik was hurting US prestige more than any sum of foreign aid could make good."91

Given the dramatic response to Sputnik, US policy makers were gravely concerned about the possibility of losing the initiative on science to the Soviets and saw the need to respond more aggressively than simply accelerating their own satellite programs. They took several concurrent steps in 1958 to expand the role of government in supporting and subsidizing science. Within the Department of Defense, they created the Advanced Research Projects Agency [ARPA] both to consolidate research allocation and attend to projects beyond the scope and any specific wing of the military. They also

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90 Dickson 131-133.
passed the National Defense Education Act [NDEA], which allocated over $3 billion to support both high school and university science education over the next ten years.\textsuperscript{92}

On July 29, 1958, Eisenhower signed the National Aeronautics and Space Act, consolidating all US civilian space efforts under one agency, the National Aeronautics and Space Administration [NASA]. In addition to absorbing the now defunct National Advisory Committee on Aeronautics [NACA], set to dissolve by the same act in October of that year, NASA would also acquire major portions of the Army and Navy satellite programs, including Wernher von Braun's team at the Army Ballistic Missile Agency, by 1960. The new agency immediately began drawing up a proposal to use its new facilities and increased funding for a series of manned missions to orbit the earth, dubbed Project Mercury. The plans were approved by NASA's new administrator, T. Keith Glennan, just six days after the agency officially began operations. These manned missions – first through Mercury, and later through the Gemini and Apollo missions – quickly dominated both NASA's budget and its appearances in the national headlines.

NASA's creation established several key elements of the public image of US space policy that have continued to the contemporary era. First, despite the context of Cold War competition in which it was created, NASA was to remain an assuredly civilian agency. Although both the Army and the Air Force continued developing and launching military satellites (primarily for reconnaissance purposes), the US space efforts was intended to be seen as one of beneficent civilian scientific progress. Secondly, while the new agency conducted its own tests and hired its own personnel, it would rely extensively on private contractors to design and build its materials. This became

particularly significant by the late 1960s, as NASA administrators repeatedly pointed to the fact that "between 85 and 90 percent of its budget was spent outside the government in partnerships with corporations, universities, and nongovernmental entities." Further, the distribution of these contractors across a number of Congressional districts helped to ensure continued legislative support for the program.  

However, despite his backing for the initial creation of NASA, Eisenhower refused to support the radical expansion in funding that manned missions to the moon would require for the remainder of his tenure. According to historian Robert Divine, Eisenhower always saw the growth of the military-industrial-scientific state as a greater threat to the American way of life than Soviet superiority. Thus, while he supported NASA's creation and limited additions to space science funding after Sputnik – mostly in the face of intense domestic political pressure and concern for international prestige – Eisenhower continued to prioritize unmanned missions for their lower cost and more immediate application. Nathan Goldman, a professor of space law, similarly notes that "An advocate of a balanced and small federal budget, President Eisenhower was leery of a space race and the expensive bureaucracy that would be necessary to conduct it …. Eisenhower was skeptical of human space flight, but he was very enthusiastic about commercial and military applications such as communications and weather satellites." This did not stop NASA administrators from developing the plans to expand on Project Mercury, even before the manned missions had begun, including a manned journey to the moon. But they would have to wait for a change in the presidency – and one more

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93 Kauffman 25-27.  
dramatic Soviet success – before they could get approval for its $20 billion estimated price tag.

**From the New Frontier to the Final Frontier**

Much has been made, particularly in popular histories, of President Kennedy's leadership on space exploration. His very visible declarations of a commitment to – indeed, even a demand for – radical progress in space sciences certainly mark memorable moments during both his campaign and the early portion of his presidential term. As Roger Launius and Howard McCurdy have argued, this has led to a mythologizing of both the man and his contributions to the US space effort, distorting their relative historical importance. This mythology undoubtedly ignores or downplays a number of other factors: the institutional momentum of military and civilian agencies pushing for the expansion of their own missions and funding; the significance of other actors within the administration, particularly Vice President Lyndon Johnson, who had long been a devoted advocate of US leadership in space sciences; Kennedy's own delay in major commitments to space exploration during his first few months in office; and popular demand for regaining the initiative in space exploration after Sputnik. ⁹⁶

However, whether or not Kennedy spearheaded space policy development, his rhetoric successfully wed space exploration to social progress by employing the mythology of the American Frontier. In his address accepting the nomination at the 1960 Democratic National Convention – later called the "New Frontier" speech – Kennedy laid out his vision for his campaign and his presidency. Noting that "we stand today on the

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edge of a New Frontier – the frontier of the 1960s… is here whether we seek it or not. Beyond that frontier are uncharted areas of science and space, unsolved problems of peace and war, unconquered problems of ignorance and prejudice, unanswered questions of poverty and surplus. In a single statement, Kennedy thus tied together the major planks of the Democratic platform in a bold vision. As he had just nominated Lyndon Johnson, a long-time space advocate and controversial figure among Kennedy's liberal base, for the vice presidency, the significance of placing "science and space" at the forefront of his platform was not lost on his audience.

At the heart of Kennedy's "New Frontier" rhetoric, though, was not just a collection of programs, but a utopian, technocratic vision in which an alliance between government and scientific expertise could provide solutions for a host of contemporary problems. The New Frontier motif united the problems of the Cold War, economic disparity, education, and the struggle for civil rights under a single banner: they all called for bold action guided by expert hands. The US role in space, suffering a series of public relations blows while quietly playing catch up with the USSR on a number of major milestones, became the central emblem of his technocratic platform.

Ironically, even as Kennedy was looking to the future, he was self-consciously tapping into a much older American intellectual tradition in his use of frontier imagery. As Henry Nash Smith has noted, the frontier was one of the dominant mythological motifs in eighteenth and nineteenth century American culture. The idea of an ever-expanding frontier, promoted in popular entertainment forms such as dime novels and Buffalo Bill's Wild West show, provided both a central motivation and justification for

westward expansion. Popular imagination of the frontier, Smith argues, envisioned a "Garden of the World," offering limitless bounty and independence. By the end of the nineteenth century, the frontier ideology gained serious weight among American intellectuals, particularly with a school of historians led by Frederick Jackson Turner. Turner argued that the expanding western frontier was the essential element in the development of an American identity. Ultimately, the Turnerian approach was an evolutionary model, in which he suggested that Americans adapted their social customs and institutions to fit the geography of the frontier, much as Darwin's finches adapted to the distinctive conditions of the Galapagos. Thus, for Turner, it was the very landscape of the frontier that engendered American democratic ideals, individualism, and technological progress, along with, of course, a propensity for violence, distrust of authority, and anti-intellectualism. However, by the time Turner introduced his thesis in 1893, the US census was already declaring the western frontier closed, as population density throughout the west approached critical mass. For Turner and his supporters, this was deeply concerning, as the end of dispersed agrarian settlement, if Turner's hypothesis were correct, likely heralded disturbing implications for American social and political organization.

Following in Turner's footsteps, Kennedy's description of the New Frontier was explicitly rooted in conquering a hostile and perilous terrain – specifically, outer space. Further, Kennedy implicitly drew on Turner's evolutionary model in his repeated calls for self-sacrifice and hardship. The rhetorical marriage between the struggles of frontier life

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and space exploration was perhaps most famously displayed in his speech at Rice University on September 12th, 1962:

We choose to go to the moon. We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win, and the others, too.

As with the Turnerian model, the very hostility of outer space would thus propel social progress, by "organizing and measuring the best" human talent America had to offer. Under Kennedy's vision, much as the danger and isolation of the American West had promoted democratic social institutions and equitable economic conditions, the challenges of space exploration would lead to the necessary social development to achieve the other major issues of Kennedy's liberal democratic platform – racial integration, Cold War superiority, anti-poverty initiatives, and expansions in education – all under the banner of a renewed frontier in space exploration. As Patricia Limerick has noted, "the 1890s vision of the frontier as the triumphant but demanding crusade of the American people made a nearly perfect match with the 1960s search for language to direct and motivate the American public."99

Few cultural sites in the 1960s would so neatly mirror Kennedy in uniting space exploration and liberal democratic ideology within the mythology of the American frontier as NBC's Star Trek. Originally aired between 1966 and 1969, Star Trek is thoroughly embedded in frontier mythology. In his pitch document for network

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executives, series creator Gene Roddenberry described the show as "Wagon Train to the stars." The series' famous opening monologue both directly conjures the West in labeling space as "The Final Frontier" and captures the dual spirit of expansion and danger. Virtually every episode has the cast and crew not only exploring unknown alien worlds, but also regularly imperiled either by the nature of the terrain itself or hostile indigenous life forms. And as Carl Abbott notes, the fact that so many of the planets visited in the show look – due in large part to budgetary constraints – exactly like the arid landscape of Southern California means that it shares essential aesthetic qualities with Hollywood Westerns.  

Critics have frequently commented on the racially diverse and international crew as a clear indication of the show's political orientation in keeping with the civil rights platform of the Kennedy and Johnson administrations. The crew includes a Japanese American pilot, a communications officer from the fictional United States of Africa, a Scottish engineer, and Spock, a half-alien first officer, all under the command of Captain James T. Kirk. Episodes frequently featured thinly veiled allegories promoting multiculturalism and racial tolerance, perhaps most transparently in "Let That Be Your Last Battlefield," in which one group of aliens with half-black and half-white skin oppress and exploit another group with reverse coloration. The addition of Ensign Chekov in the second season, even amidst some moderate sparks in Cold War tension, demonstrated the show's commitment to internationalism, along with episodes in which

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alien analogues for the Roman empire\textsuperscript{101} and Nazi Germany\textsuperscript{102} highlighted the dangers of overzealous nationalism or xenophobia.

Thus, Roddenberry and his fellow producers remained committed to using the show to promote a particular vision of progressive liberalism. More particularly, much as with Kennedy's "New Frontier," the show's view of progress is both subsumed in and expressed through the organizing spatial metaphor of outer space as the final frontier. Adhering to the Turnerian thesis, \textit{Star Trek} does not just offer a bright future, but it suggests that the postracial, postnational, postpoverty universe it depicts is made possible precisely through expansion and growth across a hostile and threatening terrain as the basis for scientific and cultural progress. Turning to the third season episode "Plato's Children," we can see this position laid bare.

The episode centers on an encounter with a planet that is both aesthetically and culturally modeled after Classical Greek society. The inhabitants of the planet initially present their society as a utopia modeled on Plato's ideals – indeed, they even call themselves "Platonians." They have purportedly evolved to the point where they no longer age or suffer from disease, and they have evolved telekinetic powers which remove the need to work, so they can devote their time to meditation and philosophy. However, the absence of disease has led to the decline of the medical arts, so their leader, Parmen, is in mortal danger from a simple cut. The Enterprise's medical officer, Dr. "Bones" McCoy, is able to rapidly heal Parmen, and he rewards the landing party with a number of gifts. Things soon take on a menacing air, however, when the Platonians refuse to let Bones leave. Parmen uses his psychokinetic powers to humiliate and torture both

Kirk and Spock in an effort to blackmail Bones into staying. The crew discovers that rather than an egalitarian utopia, the society is a rigidly ordered hierarchy based on who possesses the greatest amount of "the power." At the bottom, exhibiting no telekinetic ability, is a dwarf named Alexander, who is treated as a slave and, of course, the only Platonian sympathetic to the Enterprise crew's position. As Alexander asks them about life without telekinetic abilities, Kirk responds "We're happy without it." After a perceived insult about Alexander's size, Kirk goes on to assure him that in the Federation, "size, shape or color makes no difference."

Later in the episode, the Enterprise crew discovers a way to synthesize the element which grants the Platonians' abilities and offer to give it to Alexander. He quickly rejects the offer, exclaiming "You think that's what I want? To become one of them... to just lie around like a big blob of nothing and have things done for me? I want to move around for myself. If I want to laugh or cry, I want to do it for myself." This particular attention not only on mobility, but on self-reliance and hard work, is emphasized again as Parmen discusses Platonian history: "2500 years ago, a band of hearty vagabonds arrived on this barren, rough-hewn planet. There was a desperate hardship of backbreaking toil. And then a divine providence, graced our genius and our dedication with the power of powers." The source of the Platonians' incredible evolutionary advances is then revealed to stem from the environment of the "barren, rough-hewn planet" itself, much as Turner held that the rugged frontier created a rugged frontier people. Of course, in succumbing to their idyllic lifestyle, in which even the hardship of getting up for a glass of water has been erased, the Platonian society has withered. Kirk soon beats the Platonians at their own game, rapidly developing powers exceeding even Parmen's. In a swift, inexplicable
change of temperament, Parmen concedes defeat and promises to reform their society, noting "We have become bizarre and unproductive. We are existing merely to nourish our own power," driving home the message that constant mobility, expansion, and struggle are necessary to maintain the gains of the mythological frontier, while simultaneously echoing Turner’s own warning, nearly seventy years later, about the ramifications of a disappearing frontier. Star Trek thus succinctly offered the imaginative construction at the heart of Kennedy's "New Frontier:" a neat union between technological utopianism, the spatial metaphor of the frontier, and domestic prosperity.

Of course, while Star Trek was airing on NBC, the public relations arm of NASA had already been making similar connections for several years to promote the necessity of manned space exploration. From the beginning, NASA was concerned with its public relations activities, owing perhaps to the very public nature of the space race. When the Soviets opted to launch a simplified Sputnik I, stripped of much of its proposed utilitarian dimensions, for the sake of launching the first orbital device, they set the stage for a space race governed at least as much by dramatic images as by serious scientific progress. The decision to place men in higher and higher orbits and, ultimately, to land on the moon, was one likewise determined, at least in part, by a concern for the fantastic imagery and the imaginary dimensions of space travel.

The role of the Cold War and competition with the Soviet space program in spurring the Apollo missions cannot be overstated. After Russian successes at orbital flights, including not only the first object and first living animal in 1957, but the first person in 1961, NASA appeared still to be lagging behind in the race. US officials were concerned with the impact on their image abroad, as achievements in space science were
seen to signify the relative merits of the competing economic and political systems. It is worth noting that these perceptions were not necessarily based on an objective evaluation of the scientific merits of the competing space programs. In the period from 1957 to 1961, NASA launched many times more satellites than their Soviet counterparts, and those satellites were generally capable of collecting more data and performing more complex functions than the Soviet equivalents, as NASA officials made sure to mention at every opportunity. *Time*, a relatively consistent NASA booster, noted in 1960 that:

> As of last week, Russia had successfully launched four earth satellites and three space probes. Against that, the U.S. has put 19 satellites into earth orbit, fired two successful deep space probes. So commonplace has U.S. space achievement become that it almost escaped public notice last week when an Aerobee-Hi rocket shot 137 miles into the air with eight ultraviolet telescopes to analyze starlight. Of ten satellites still circling the earth, nine came from the U.S. – and the information they have sent to earth has changed forever man's ideas of the universe.  

Despite these efforts to combat the idea that they were losing the space race, however, NASA's image continued to suffer. The relative scientific advantages of NASA's satellites and probes were insignificant in the face of so many theatrical "firsts" by the Russians. Following Yuri Gagarin's flight as the first human being to orbit the Earth in 1961, US policy makers realized that they needed a similarly striking achievement. As James Kauffmann notes, "Kennedy's remarks at a press conference the following day demonstrate the importance he placed on achieving a dramatic space shot. When questioned about America's future plans in manned space flight, Kennedy stated that the

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United States must determine whether any program, 'regardless of cost,' would enable it to be 'first in any new area.'\textsuperscript{104}

The designation of a manned lunar lander was not an arbitrary choice based on where the US could make \textit{any} first achievement, however. NASA representatives were often promoting the idea that the US maintained an overall lead in space sciences, and they did indeed achieve any number of very practical "firsts," such as launching the first communications satellites. Additionally, there were significant questions about whether a manned mission would provide any scientific advantage over a less expensive, unmanned voyage. Nevertheless, as Vice President Johnson wrote, "regardless of their appreciation of our idealistic values, [other nations will] align themselves with the country they believe will be the world leader …. [D]ramatic space accomplishments [are a] major indicator of world leadership."\textsuperscript{105} Dramatic, in the context of 1960s space science, was nearly synonymous with manned flight. To regain its international prestige, the US needed something that was not just a scientific breakthrough, but a significant spectacle in its own right.

Thus, it was with an eye toward the theatrical that Congress and the President committed to a manned flight to the moon. As Nathan C. Goldman writes,

\begin{quote}
Only one day after Gagarin's flight, the House Committee on Science and Astronautics held hearings on this latest Russian success. NASA officials heard and answered the same questions that the president had asked: What were the Soviets doing in Space? When could the United States match them? Many analysts believed that the Soviets were planning to land cosmonauts on the moon
\end{quote}

\textsuperscript{104} Kauffmann 20.
\textsuperscript{105} As quoted in Kauffman 21.
by 1967, the fiftieth anniversary of the Russian Revolution. On the other hand, the members of Congress heard that the United States could reach the moon by 1970. Closing that three-year gap and beating the Russians to the moon would cost $4 billion to $5 billion a year, 3 percent of the budget. The president and the Congress accepted the challenge and adopted the policy of landing a man on the moon in that decade.\textsuperscript{106}

Even before Gagarin's successful orbit, NASA had chosen to emphasize the human component of the space program. As James Kauffman notes, during the early phases of the Mercury missions in 1959 and 1960, "astronauts often called their missions 'rides.' They used various expressions, like the 'Redstone ride' or 'riding the capsule.'" However, beginning in 1961 as part of a deliberate maneuver from NASA's public relations department, astronauts changed their terminology when speaking to the press: instead of riding a capsule, they would fly a spacecraft, suggesting their active control of a pilotable ship. At the same time, they would refer to Soviet cosmonauts as passengers, and downplay the level of control they exercised over their crafts.\textsuperscript{107} Establishing the astronauts as active agents in their flights was central to the project of elevating them to the status of heroes. Much more than mere passengers strapped to a rocket, they became bold pioneers at the heart of a high-adventure story hearkening to the mythology of America's frontier days.

As NASA was choosing to emphasize the embodied dimension of space travel, it is worth discussing which bodies were at the heart of this mythology. Even with both Eisenhower and Kennedy's calls for the exploration of space to remain a peaceful

\textsuperscript{106} Goldman 11.
\textsuperscript{107} Kauffman 85.
endeavor, nearly all the astronauts of the 1960s had strong ties to the military. Most of the first three groups of astronauts selected by NASA were active duty members of the Navy, Air Force, or Marine Corps at the time. Neil Armstrong has often been credited as the first civilian astronaut, but while he was a civilian at the time of his selection as an astronaut, he had previously served as a celebrated combat pilot for the Navy during the Korean War. It was not until 1965 that the selection of Astronaut Group 4 included men with no previous military service. None of Group 4 would reach outer space in the 1960s – Harrison Schmitt, a geologist, would become the first to do so when he piloted the lunar module for Apollo 17 in 1972.

Further, the bulk of the astronauts selected in the 1960s not only had military backgrounds, but had specifically served as test pilots for the military. Eisenhower explicitly mandated that the first group of astronauts selected for NASA were military test pilots. Even later astronauts selected without previous test pilot experience – beginning in Astronaut Group 3 – were required to complete test pilot training as part of their astronaut conditioning. Having test pilot experience was arguably pertinent to their duties, particularly under the solo Mercury missions. Selecting test pilots, however, also helped to contribute to the mythologized image of the astronaut in two ways – first, by identifying them as rugged, adventurous individualists willing to place their life at risk for love of country. And second, by further promoting the notion that they, and not the automated systems on the spacecraft, were in control of the flight.

In the lead up to manned spaceflight, the popular press often focused a good deal of attention on the intense physical testing astronauts had to undergo. A Time magazine article was not unusual in either its content or floridity of prose when it described the
astronaut training: "they were guinea-pigged into hot chambers and cold, wild rides in 20-G centrifuges and in disorientation machines that whirled them around till they became physically sick. They lived for days at a time in pressure suits … [and now] will undergo even more rigorous physical and mental testing. They will spend two hours in a superheated chamber (130° F.), withdraw into a dark, soundproof room for hours at a time to test their ability to endure isolation, and will be exposed to piercing, high-frequency noises."108 Similarly, a New York Times article under the headline "Astronauts Face Rugged Program: Seven Men Will Be Tumbled, Whirled and Hurl Before Space Flight" noted that "The nation's first astronauts, before soaring through space in a capsule, will be tumbled about on earth in a 'disorientation' device resembling a cement mixer. As part of their training program, the seven Mercury Astronauts will be whirled on human centrifuges, places in heat and pressure chambers and hurled down over the Atlantic Ocean like a ballistic missile warhead."109 Throughout the Mercury, Gemini, and Apollo programs, the fixation on extreme bodily suffering – and the astronauts' ability to endure it – remained in the press.

However, the astronauts were also required to be cerebral and scientifically apt – from the start, a bachelor's degree in engineering or physical science was a mandate for all NASA astronauts. With the exception of John Glenn, who was selected despite failing to meet this requirement, all of the initial seven NASA astronauts held degrees in engineering. Beginning with Group 2, it was common for those selected to hold advanced degrees in engineering or a related field. One Time article describing the upcoming Gemini missions argued that "One of the men on board will have to handle a complex

computer as rapidly and efficiently as a secretary drumming on a typewriter. He will need the know-how necessary for interpreting the readings of new, esoteric instruments. For this futuristic job, an M.I.T. doctorate may soon be more of a recommendation than many years' experience as a test pilot."¹¹⁰ The challenges of the "New Frontier" required not just military discipline, bodily strength, and an almost masochistic ability to withstand pain, but also technical savvy and an understanding of scientific principles.

Additionally, the popular nomenclature for the astronaut selection groups highlighted their elite status. The first three NASA Astronaut Groups were commonly referred to by the press as, respectively, "Mercury Seven," "The New Nine," and "The Fourteen." Given the amount of attention to an application process that included hundreds of applicants for each group, the emphasis on the limited number of individuals who were chosen drove home the point that these were elite figures even among the outstanding pools of applicants from which they were selected. Apollo Group 4, selected in 1965, became the first group to break this pattern when it was dubbed, appropriately, "The Scientists," as all six had doctoral degrees. Nevertheless, four of the six Scientist-Astronauts had previous military experience, and Owen Garriott also completed the US Air Force Pilot Training Program.

Perhaps to prevent their extraordinary standing from placing them out of touch with viewers and readers, the press displayed an intense fascination with the astronauts' family lives and domestic activities. From nearly the moment the identities of the Mercury Seven were released, stories about their wives and families began appearing in the middlebrow press. Details about their home lives and children's interests could regularly be found on newsstands, sometimes to the astronauts' chagrin. On the eve of his

first orbital flight, John Glenn complained that "some newsmen appeared most interest in such things as 'how Annie [Mrs. Glenn] is getting her hair fixed,'" rather than the details of the mission or Glenn's own achievements.¹¹¹ Stories about an astronaut's last meal before his mission were a regular feature of space coverage, and the food they would eat during their mission – including powdered Tang and freeze dried ice cream – became something of a national obsession. After Scott Carpenter's orbital flight on Aurora 7, the New York Times ran an article about his mother's preparations to meet him after his landing.¹¹² Another article in 1962 described Gordon Cooper's process of selecting a new home in Florida.¹¹³ Details about how astronauts would eat, sleep, or use toilets in a zero gravity environment were covered by the popular press repeatedly as well. These stories collectively worked to establish the astronauts not just as men, but as family men with domestic lives. Much as Henry Nash Smith argued that the classic frontier hero presented a mitigating force between an untamed wilderness and an overly civilized domestic space who had to paradoxically embody both worlds, so too did the astronauts function in US public life as a means to bridge the gap between the domestic terrestrial environment and the wholly unknown realm of outer space.

This fixation on the family lives and basic bodily functions of astronauts is consistent with the phenomenon Amy Kaplan has described as "imperial domesticity" in representations of the Western frontier during the nineteenth century. Examining the repeated depiction of white homes and family life at the sites of imperial contact, she contends that these constructions of domestic life worked paradoxically both to establish

firm boundaries and simultaneously break them down in the pursuit of unrestricted expansion. As she writes,

The spatial representations of domesticity and Manifest Destiny seem to exemplify the divisions between female and male spheres: the home as a bounded and rigidly ordered interior space as opposed to the boundless and undifferentiated space of an infinitely expanding frontier …. [However,] these gendered spaces were more complexly intermeshed; that 'woman's true sphere' was in fact a mobile and mobilizing outpost that transformed conquered foreign lands into the domestic sphere of the family and nation. At the same time, the focus on domesticity could work to efface all traces of violent conflict, as the foreign qualities of the Rio Grande magically disappeared into the familiar landscape of New England.¹¹⁴

Although there were no permanent settlements – and, indeed, no American women – in space during the 1960s, these images of astronauts' home lives performed similar ideological functions in at least two ways. First, the contrast between images of the hostile environment of outer space and a tranquil family life on Earth helped to establish the former as an explicitly and rigidly male sphere. Simultaneously, they allowed for the conquest of space while erasing the international conflict that spurred this exploration, presenting the US missions as benevolent scientific progress rather than strategic Cold War maneuvering.

Considering the stringent requirements for entry to the program, it may be unsurprising that most of the astronauts shared similar backgrounds and characteristics.

However, at least one requirement—completing a military jet pilot training program—was seen as structurally unfair, even by some contemporaries, as it was inaccessible to women at the time. In 1960, William Randolph Lovelace, a physician who had contracted with NASA to conduct some of the physical tests on the Mercury astronauts, privately funded a program to recruit women to undergo some of the same tests. Thirteen of them passed all of Lovelace's tests with scores that matched or beat the Mercury astronauts, and subsequently petitioned NASA for their inclusion in the program. The program dissolved when Lovelace ran out of funds, and it had never received an endorsement from NASA, but it gained national attention in 1962 when hearings were held by the House Committee on Science and Aeronautics on the question of gender discrimination in the astronaut training program. Ultimately, the committee upheld NASA's decision, noting that even though many of the women had experience as civilian test pilots, none of them had worked with high speed jet aircraft before. While Lovelace's program did not spark any official policy changes—women would not be admitted as NASA astronauts until the selection of Group 8 in 1978—it did evoke a good deal of speculation in the press about whether male pilots really held a significant advantage in navigating spacecraft. A multipage New York Times article titled "Why Not 'Astronauttes' Also?" suggested that not only were women capable of becoming astronauts, but would likely prove better suited to the program in several regards. In particular, their smaller size and lower caloric intake, it argued, would allow for smaller, lighter craft.116

115 The most comprehensive coverage of this is found in Martha Ackmann's The Mercury 13: The True Story of Thirteen Women and the Dream of Space Flight, which sparked a minor controversy after it was assigned as mandatory reading for the freshman class of 2007 at the University of Wisconsin at Oshkosh. Francis French and Colin Burgess also offer an account in Into That Silent Sea: Trailblazers of the Space Era, 1961-1965.
None of this stopped the USSR from recruiting their own female cosmonauts several months before the Science and Aeronautics Committee hearings were held. After recruiting five women as cosmonauts, they achieved another space first when they launched Valentina Tereshkova, in Vostok 6, to orbit the earth forty-eight times over the course of three days, logging more time in space than all the American astronauts combined at that point. NASA officials were quick to dismiss the selection of a female as a "stunt," although they did so without betraying any notion of irony about their own focus on manned flight as a public relations maneuver. This was more than just competing bureaucracies sniping at each other; however; the choice of Tereshkova highlights a discrepancy in national priorities for the respective space programs. Tereshkova was selected not only for her gender but for, as Yuri Gagarin before her, her explicitly proletarian background. While the presentation of NASA's selection of astronauts repeatedly emphasized their standing as the "best of the best," or alternatively the "right stuff," an image later crystallized by Tom Wolfe into a more permanent mythology, the Soviet program was committed to a celebration of the Marxist proletariat.

At least one other incident from the astronaut selection process highlights this difference. Following a suggestion from Edward R. Murrow, then director of the US Information Agency, that were NASA to select a black astronaut, "we could retell our space effort to the non-white world, which is most of it," President Kennedy began to pressure NASA to select a black candidate for astronaut training. Air Force pilot Edward J. Dwight was selected for the position and entered the astronaut training program. However, he was met with stiff resistance by both NASA administrators and the Air Force chain of command. After Kennedy's assassination, executive support for Dwight's
entry to space fell away as well, and Dwight eventually resigned from the program and the Air Force in 1966.\textsuperscript{117} Thus, while outer space was often leveraged as an imagined solution to domestic racial tensions, the conception of an elite astronaut corps was not yet able to incorporate racial difference. Nor would it for over a decade, by which point much of the fervor and celebration surrounding contemporary astronauts had largely died off, even as the elite and exclusively white male Mercury, Gemini, and Apollo astronauts continued to be mythologized and memorialized in national memory.

2001: A Space Odyssey

Kaplan has argued that "A key paradox informs the ideology of American exceptionalism: it defines America's radical difference from other nations as something that goes beyond the separateness and uniqueness of its own particular heritage and culture. Rather, its exceptional nature lies in its exemplary status as the apotheosis of the nation-form itself and as a model for the rest of the world. American exceptionalism is in part an argument for boundless expansion, where national particularism and international universalism converge."\textsuperscript{118} Space exploration came to embody this exceptionalist ideology in the 1960s, both promoting the particular superiority of United States science and industry and wrapping that superiority in an envelope of international humanism. This can perhaps best be seen in Stanley Kubrick's 2001: A Space Odyssey (1968), the

\textsuperscript{117} For an account of these events, see: J. Alfred Phelps. They Had a Dream: The Story of African-American Astronauts. Reprint. New York: Presidio Press, 1995. Print. Although this section of his text is largely based on an interview with Dwight himself, the relevant portions are corroborated by test pilot Chuck Yeager, who was caught between the Kennedy administration and the Air Force chain of command, in his memoir Yeager: An Autobiography.

\textsuperscript{118} Kaplan 15.
grandest fictive effort of the era to attempt the science factual aesthetic by then so tightly linked to the space program.

Kubrick's quest for scientific accuracy in *2001* has been extraordinarily well-documented. He employed multiple science consultants to address different elements of the film – an anthropologist for the primitive ape-man sequence, a computer scientist for the behavior of the intelligent HAL computer, and Frederick I. Ordway III, a rocket scientist who had worked with Wernher von Braun at both the ABMA and NASA, for the physics of spaceflight. In addition to countless film critics, amateur space enthusiasts, and even NASA analysts, Ordway himself has written extensively about his contributions during the films and the accuracy of the finished project.\(^{119}\) The extensive efforts to photorealistically display space travel included developing new film techniques – such as the first large-scale front projection – and construction of elaborate sets, including a 30-foot rotating wheel that cost $750,000 to build. Much as *Destination Moon* had done nineteen years earlier, albeit to a much less successful degree of accuracy, Kubrick tapped rocket and ship designs from leading rocket scientists of the day. This included a rotating space station remarkably reminiscent of von Braun's design in the 1953 *Collier's* series.

Further, he refused to use blue screens, insisting that all special effects be completed in camera to maintain the integrity of the image. Indeed, the film presents a compelling enough sense of visual authenticity that as recently as 2011 conspiracy theorists have suggested that Kubrick used the same techniques to help NASA fake the Apollo 11 moon

As an aesthetic achievement, then, 2001 can thus be considered the pinnacle of the science factual movement of the mid-century.

Kubrick's plot, developed in collaboration with British science fiction author Arthur C. Clarke, takes place in four parts. The opening sequence concerns a tribe of anthropoids, presumably the immediate ancestors of humankind, who encounter a mysterious black monolith that inspires them to fashion a basic tool from a bone. At the conclusion of this section, the anthropoids' leader throws the bone into the air where it is match-cut to an orbiting satellite, heralding the arrival of the space age. The next section details Dr. Heywood Floyd's journey, via space shuttle, to a lunar base where a similar black monolith is discovered. The third act, which comprises the longest portion of the film, focuses on the conflict between two human crew members and the ship's computer, HAL 9000, on board a voyage to Jupiter. The closing segment of the film, in a dramatic visual departure from the first three acts, is composed mostly of a sequence of color-distorted, abstract images ostensibly representing Dr. Dave Bowman's experience after the discovery of the final monolith.

At the conclusion of this final sequence, Bowman undergoes a series of rapid shifts in perspective, witnessing himself aging and dying, before being reborn as a fetus-like creature, dubbed the "star child," orbiting and overlooking the Earth. At its most basic level, then, the film suggests a neat view of technological progress. From the match-cut of bone and satellite through the arrival on the moon and voyage to Jupiter, we are presented with an unbroken narrative journey from primitive man to Bowman's ascension to a higher state of being. The hyperwhite backdrops and clean lines of the

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space station design assure us of a pleasant, if utterly banal, future. As De Witt Douglas Kilgore writes, "By narrative convention and design, 2001 presents the space future as a fulfillment of the technological utopianism embodied in the white cities of the modern world's fair movement: clean, bright, patriarchal, Eurocentric, affluent, and supported by a push-button technocracy."\textsuperscript{121}

Certainly, 2001 engages in a number of the conceits of both utopian space imagination and American exceptionalism. For example, the cooperation between science, the state, and industry is drilled home during Dr. Floyd's passage to the moon, as we see corporate enterprise thriving in space from the Pan Am shuttle he rides to the Hilton hotel and Howard Johnson restaurant on the orbital space station. Likewise American superiority is assumed: despite the presence of Russian scientists on the space station, it is Americans who discover the second monolith and comprise the entire crew of the Discovery ship. And, of course, at the heart of the film's narrative is the notion that it is the particular technology of space travel, beginning with colonization of the moon, that will usher in the omniscient American star child.

Additionally, contrary to generic science fiction conventions of the era, Kubrick's film offers little in the way of scientific exposition. Whereas a film like Destination Moon relied on both the Woody Woodpecker animated short and constant back-and-forth dialogue with the on-screen scientists to explain the action to its viewers, 2001 offers virtually no verbal explanations of the physical principles of space travel or the high technology on display, apart from a few brief discussions of HAL's nature. Rather, the film constructs its sense of scientific veracity nearly entirely at the visual level, with

\textsuperscript{121} Kilgore 223.
lengthy sequences demonstrating orbital alignments and zero-gravity motion, either silently or set to symphonic music. While early drafts of the script included a narrator, Kubrick cut these in favor of a more directly visual experience. The end result of this naturalistic presentation is that an affective familiarity and comfort with the technology on display is imposed on the audience; rather than answering skepticism with explanation, 2001 dismisses it out of hand.

Of the few scenes of life on Earth after the opening act of 2001, all of which take place over videophone or by prerecorded message, two of them are dedicated to domestic life. In the first, Dr. Heywood holds a brief conversation with his young daughter, asking what she would like for her birthday. In the second Dr. Frank Poole, on the Discovery, receives a video message from his parents. Much as with the emphasis on the family lives of the real Mercury and Apollo astronauts, these scenes serve both to render the boundaries between space and Earth more concrete – as the communication takes places across impossible distances – and to domesticate space, rendering it comprehensible. That the few women with significant time on screen are flight attendants only further reinforces the suggestion that the outward expansion is ultimately measured by successive waves of feminized domestication.

Further, much as Apollo 11 would later serve paradoxically as both an American Cold War victory and an achievement for all humankind, 2001 first evokes and then erases a backdrop of Cold War confrontation. When Floyd encounters Dr. Andre Smyslov aboard the space station, the latter's over-acted shiftiness and probing questions are clearly intended to evoke the threat of espionage. Similarly, the connection between Cold War anticommunism crusades and Floyd's suggestion that all the scientific personnel
aware of the second monolith would be required to give "loyalty oaths" would not have been lost on contemporary audiences. However, these narrative threads disappear, unresolved, from the second half of the film, to be replaced by the conflict between HAL and the human astronauts on board Discovery. Much as the intertribal conflict of the anthropoids becomes submerged in the collective entrance of humanity into the space age, so the expansion and exploration of the American ship is seen as the next step in a natural evolution for all humankind.

However, the film also suggests several disjunctures with American exceptionalism, in both its narrative and its aesthetics. In terms of narrative, the fact that the major menace in the film comes from HAL cannot be overlooked. The ultimate threat to the Discovery crew comes neither from hostile aliens as the presence of the monolith initially suggests nor from the environment as in other space exploration films, but from the very technology meant to propel them into a new era. More importantly, the presentation of this conflict offers a good deal of ambiguity as to its interpretation. We are led to believe that HAL's psychosis emerges from the demand that he withhold information, not from an inherent fault in his construction, and he only turns violent after he learns of the crew's plan to disconnect his higher brain functions. HAL's murder of Dr. Frank Poole takes place silently, off-screen, and the deaths of the three hibernating scientists on board Discovery are shown through the gradual, mechanistic decline of their vital signs. In contrast, when Dave Bowman finally manages to disconnect HAL, HAL pleads with him, repeatedly, to "Stop Dave. Will you stop Dave? I'm afraid. I'm afraid Dave." It is a highly affective scene, in which Dave's measured breathing is paired with close up shots of his face, framed by the spacesuit, as perspiration drips down his cheeks.
HAL’s termination is then drawn out as he sings "Daisy Bell," a sweet, simple love song. The moral certainty of our identification with Dave against HAL is thus anything but conclusive.

At the aesthetic level, the film offers two additional ruptures. First, in carrying the science factual to an extreme representation, 2001 becomes rather affectively barren. It offers a visually stimulating and even beautiful vision of the future, but one largely devoid of emotional attachment. For example, as Frank Poole listens to the aforementioned message from his parents, his face is blank and devoid of reaction. Likewise, as Dave Bowman faces a near certain death in his effort to re-enter the Discovery ship without a helmet for the airlock, he offers only the slightest hint of anxiety as he flatly considers his prospects. Perhaps the most telling example comes with our introduction to Dr. Floyd who, during his initial appearance on his voyage to the space station, is gently dozing, as a marked contrast to the depictions of astronauts facing extreme danger and high adventure. The overwhelming affective tone of the film – and perhaps an accurate one given the vast, empty distances of space – is one of loneliness and isolation rather than excitement or high adventure.

Finally, the closing segment of 2001, "Jupiter and Beyond the Infinite," reverses the relationship between fact and fantasy of the earlier science factual creations. Both Destination Moon and the Disney "Tomorrowland" episodes moved aesthetically from highly stylized or cartoonish animation towards the photorealistic. This aesthetic movement parallels their ideological efforts to render the fantasy of spaceflight as an attainable reality. In contrast, to an audience in 1968, on the verge of the first manned moon-landing, space travel was already imminently feasible. Kubrick chose to transition
from an extreme degree of verisimilitude in his representations of a technological milieu
not so far removed from the audience's own position, to abstract, largely
incomprehensible images in his closing. We are treated to scenes, flashing in rapid
succession, of unreal landscapes, vague nebula-like formations, and exploding flashes of
color. In this rapid stylistic transition, it is the utopic promises of space travel that are
pushed into the realm of the inaccessible, rather than the other way around.

Fifteen months after the release of 2001, the manned NASA missions reached
their zenith of public interest with the successful launch and touchdown of Apollo 11. On
July 16th, the crowds gathered to watch the launch at the Kennedy Space Center – which
already numbered in the thousands for previous Apollo launches – were so numerous that
spectators crowded nearby highways and beaches. Millions more watched the event
broadcast live on television. Four days later, the lunar module landed, and the whole
world watched as Neil Armstrong became the first man to walk on the moon. With six
months to spare, the mission delivered on John F. Kennedy's promise that the United
States could land a man on the moon by the end of the 1960s. Further, it did so prior to a
Soviet landing – which never would occur – exorcising the ghost of Sputnik for the
remainder of the Cold War.

That the mission was carried out with only relatively minor technical difficulties
was a testament to the substantial American science and engineering efforts of the past
two decades. That the landing was able simultaneously to occupy so many contradictory
ideological roles is a testament to the enduring power of American exceptionalism.
Armstrong's famous words after touchdown, "That's one small step for man, one giant
leap for mankind," became an instantly mythologized symbol of human progress. The
samples collected and the scientific instruments left behind would contribute substantially to international space science efforts. The declaration on the plaque left behind, "We came in peace for all mankind," spoke to NASA's civilian mission statement. The American flag they planted, on the other hand, spoke to their victory over their Soviet opponents in the space race.

Ultimately, the space age, with NASA as its champion, was able to deliver on some of its technical promises, but the public grew increasingly disenchanted as its utopic projections remained out of reach. Over the next three years, NASA sent six more manned missions to the moon. However, both public interest and public funding were already dwindling. At the close of the 1960s, manned flight to the moon had been achieved, but the social problems space enthusiasts had ideologically fused to space travel – racial tension, poverty, and international conflict – remained as significant as ever back on Earth. While interest in NASA spiked again during times of acute crisis, e.g. during the imperiled Apollo 13 mission and following the Space Shuttle Challenger explosion, the agency would not command the sustained public fascination it garnered in the 1960s for the remainder of the century. The last manned mission to the moon, Apollo 17, returned to Earth in 1972, and no astronauts have ventured beyond low earth orbit since that time.

It took the combined effort of NASA officials, space enthusiasts, science fiction writers and filmmakers, and a complicit press to transform the science fictional premise of a journey to the moon into a reality. The successful transition of that fiction into fact speaks to the significance and cultural momentum of that movement. Ironically, the fact that decades after the Apollo missions concluded, a great number of conspiracy theorists
and hoaxsters maintain that the landings were an elaborate forgery also speaks the
successful merging of fact and fantasy.
Chapter 3: Bad Blood and Hypersouls

The extent to which the discourses of biological and medical sciences have historically been put to use to justify and endorse state-sanctioned racialized exploitation in the United States has been documented so thoroughly by scholars working in both African American Studies and Science Studies that it is difficult, at this point, to imagine a scenario more gruesome than the historical record already shows. And beyond providing epistemological justification for racist policies, US scientific communities and institutions have gained immense direct benefits from racial segregation and dehumanization – in the form of readily exploitable bodies, both living and dead, for experimentation. As a number of scholars, including Dorothy Roberts, Patricia Hill Collins, and Harriet Washington have demonstrated, there is a long history in the United States of state sanctioned scientific exploitation of and experimentation on black bodies.\(^{122}\) The extremely complex and intricate epistemologies of biological racial difference dominant in the nineteenth and early twentieth century US thus existed as a coproduction of both the state and scientific expertise.

While it is relatively easy, from the standpoint of the early twenty-first century, to dismiss many of these epistemologies as 'pseudoscience,' it is important to understand that they were constructed and presented as scientific knowledge in their time. As Stephen Jay Gould famously documented, for example, the leading medical researchers and institutions of the nineteenth century held that intelligence was a direct product of

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racially determined physical attributes, such as skull size and shape – arguments which were then used to support continued racial enslavement or segregation. Certainly, histories such as this serve as a cautionary tale for both scientists and science critics to be cautious of drawing conclusions beyond those immediately supported by the data. However, as Gould argues, it would be remiss to label these as the 'bad science' of a past era. These were not fringe figures operating at the margins, but rather central to the production of scientific knowledge and expertise of their time.123

However, as discussed in the previous chapter, by the middle of the twentieth century, the belief in scientific progress as a solution to social ills had become widespread within American culture and political rhetoric, including in the "New Frontier" campaign of John F. Kennedy. Additionally, as DeWitt Douglas Kilgore argues, midcentury science fiction frequently offered technological projects, from nuclear energy to space travel, as efforts to address themes of civil rights, poverty, and international conflict through a host of allegorical figures from robots to aliens. These science fictional themes were neatly mirrored by a political belief in technological utopianism – a philosophy of governance that Howard Segal traces back through at least the mid-nineteenth century, and which he argues found a resurgence through the New Deal and Great Society platforms.124

But when midcentury science fiction addressed racial difference, it generally did so through a modernist frame which rendered race – and by extension blackness – as a premodern phenomenon.125 In other words, the "postracial" future conjured in the science fiction of the 1950s and 1960s was an explicitly white future: there would be no more

125 Kilgore.
racial conflict because people of color would no longer exist. Bould argues that "by presenting racism as an insanity that burned itself out, or as the obvious folly of the ignorant and impoverished who would be left behind by the genre's brave new futures, [science fiction] avoids confronting the structures of racism and its own complicity in them."126 In 1972, however, the revelation of the Tuskegee syphilis experiments in the popular press made it tragically and painfully clear that scientific research was anything but free of the structural racism in American society.

It is against this backdrop of colorblind technocratic utopianism coupled with racialized scientific exploitation that Afrofuturist aesthetics emerged as a distinct mode of critique. In marked contrast to the utopianism described by Kilgore, Afrofuturism is highly critical of state scientific enterprises, and particularly the exploitation of communities of color by those enterprises. Looking at the work of one Afrofuturist pioneer, Sun Ra, we can see the links in Afrofuturism between the rejection of state scientific enterprises and the embrace of an alternative, racially specific technological enthusiasm. Specifically, I argue that Sun Ra's articulation of Afrofuturism works to undermine the totalizing truth claims made by state scientific agencies in the twentieth century by positioning black bodily trauma as the direct result of such claims. Despite this trauma and vulnerability, however, Sun Ra does not advance an image of blackness as tantamount to victimhood or subjugation. Rather, by offering his own 'myth-science' philosophy as an alternative regime of truth, he embraces a tactical recovery of an embodied black identity to assert black agency in the creation of a racially specific future.

Afrofuturism is a complex cultural movement. Very few artists or other cultural producers have explicitly identified themselves as Afrofuturists – rather, it is an analytical term employed by scholars to describe a diffuse set of signs and aesthetic modes that span a variety of media and cultural forms. Lisa Yaszek offers perhaps the most succinct definition when she describes Afrofuturism as "an international aesthetic movement concerned with the relations of science, technology, and race, [that] appropriates the narrative techniques of science fiction to put a black face on the future."\(^{127}\) The common elements in the genre reside in the coupling of science fictional and utopic tropes with Afrodiasporic identity and culture in the interest of crafting a racially specific and identifiably black future.

The term was first coined by Mark Dery in his 1994 interview essay, "Black to the Future," in which Dery attempts to interrogate the relative invisibility of African Americans in both the production and audience of mainstream science fiction. During one of the interviews, Samuel Delany, himself a prolific and critically acclaimed African American science fiction author, offers an explanation as follows: "It was fairly easy to understand why, say, from the fifties through the seventies, the black readership of SF was fairly low …. The flashing lights, the dials, and the rest of the imagistic paraphernalia of science fiction functioned as social signs – signs people learned to read very quickly. They signaled technology. And technology was like a placard on the door saying, 'Boys Club! Girls, keep out. Blacks and Hispanics and the poor in general, go away!'"\(^{128}\)


Earlier in the same essay, however, Dery suggests that a number of science fictionnal tropes may have particular relevance to the historical experiences of African Americans in the United States. "African Americans, in a very real sense, are the descendants of alien abductees; they inhabit a sci-fi nightmare in which unseen but no less impassable force fields of intolerance frustrate their movements; official histories undo what has been done; and technology is too often brought to bear on black bodies."129 These narrative connections between science fictional themes and African American identity have been echoed by a number of Afrofuturist scholars, including Alondra Nelson, Tricia Rose, and Greg Tate. However, where here Dery highlights African Americans as victims of technological enterprises, subsequent scholars in both Afrofuturism and within the history of technology at large have done excellent work in calling attention to the often overlooked technological innovation and agency of black creators in the United States, in wide ranging arenas from the cultivation of rice in the antebellum South to advancements in digital music sampling in the late twentieth century.130

It is difficult to pinpoint the exact origin of any genre, and Afrofuturism, with its diffuse set of both expressions and influences, is no exception. Yaszek, for example, offers a compelling argument for Ellison's *Invisible Man* (1952) as a proto-Afrofuturist text, while others have suggested that the theology developed by the Nation of Islam in

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129 Dery 180.
the 1940s contains many of the seeds for Afrofuturism. Nevertheless, there is a loose consensus that Afrofuturism emerged as a distinct and identifiable aesthetic by the early 1970s, particularly with the popularization of the music and stage performances of George Clinton and Sun Ra.

For example, George Clinton's 1975 album with Parliament, *Mothership Connection*, clearly evokes an Afrofuturist mode. The album cover features an illustration of a black man emerging from a cylindrical spaceship – the classic UFO design – wearing a shiny, metallic suit with disco heels. Lyrics highlight an "outerspace DJ" and intergalactic voyages. The title track, "Mothership Connection (Star Child)" describes an outerspace voyage (and the subtitle may be a reference to the "Star Child" at the conclusion of Kubrick's *2001*), while lyrics quote the traditional spiritual "Swing Down, Chariot," itself a satirical adaptation of the slave spiritual "Swing Low, Sweet Chariot."

As Clinton himself describes it: "We had put black people in situations nobody ever thought they would be in, like the White House. I figured another place you wouldn't think black people would be was outer space. I was a big fan of *Star Trek*, so we did a thing with a pimp sitting in a spaceship shaped like a Cadillac, and we did all these James Brown-type grooves, but with street talk and ghetto slang."\(^{131}\)

J. Griffith Rollefson has argued that Clinton's "P Funk mythology," which began with "Mothership Connection," articulates what he calls "hypersoul." According to Rollefson, hypersoul is an effort to rehabilitate soul, a traditional locus of black authenticity. The roots of this authenticity lie in the black body – of the pimp figure on the album's cover, the outerspace DJ, and of Clinton himself – and in distinctly

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Afrodiasporic musical traditions. By emphasizing the black body and the achievements of African American musicality, soul has been used as a basic claim to human dignity, dating at least to W.E.B. DuBois' *The Souls of Black Folks*. However, Rollefson argues that the use of soul in Afrofuturism is only a *tactical* recovery: "P Funk mythology," and Afrofuturism as a whole, in a postmodern turn, also resists any claims to an authentic personhood. Rather, Afrofuturist artists, he argues, consistently insist upon their own hybridity, and collapse the distance between "white science" and "black magic." Clinton's voice, as it is distorted, amplified, and broadcast over radio waves, is a prime example. Rather than position blackness and science as an antithetical Hegelian dialectic, Clinton writes blackness into the future.¹³²

Similarly, I argue here that Sun Ra's music, stage identity, and "Myth-Science" philosophy presents a tactical recovery of another sort: specifically, of black bodily trauma at the hands of white state science. Sun Ra's articulations of history, mythology, and linguistics consistently highlight not only the constructed nature of Negro identity, but its specific construction as a category of victimhood. Further, his 1974 film *Space is the Place* positions state scientists as the genesis of that trauma, echoing the controversy surrounding the Tuskegee syphilis experiments. However, his work also resists establishing any easy oppositional dyad: he remained as skeptical of a totalizing black subject position as he did of a race-free white science. Instead, his music, stage performances, broad sheets, and university lectures embrace a hybridity of the two positions to deny any attempts to force them into one camp or the other. Drawing freely from images of both science fictional utopian futures and mythological African pasts, Sun

Ra's Myth-Science collapses the conceptual distance between the two, both to critique contemporary society and insist upon black agency in the creation of the future. At the heart of this critique, however, were the trauma and dispossession of black bodies by state science: forces with centuries-long roots, which came roaring to the forefront of the popular imagination in the early 1970s.

**Tuskegee**

On July 25, 1972, a news story about a medical study conducted in Tuskegee, Alabama, appeared in the *Washington Star*. It would dominate the national headlines in the coming weeks and leave a chilling legacy for years to come. The study, called "Untreated Syphilis in the Male Negro," followed 600 African American men in Macon County, of whom 399 were diagnosed with syphilis and left untreated. As the facts of the case became widely disseminated and discussed, it became rapidly apparent that scientific racism was not just a nineteenth century phenomenon, nor had it ended with the elimination of formal segregation in the Jim Crow South. Rather, the study revealed that the very project of public health research was embedded from the beginning with racial logic of a particularly destructive nature.\(^{133}\)

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The study, which began in 1932, was initially conducted by the US Public Health Service [PHS], and continued over the next forty years through both a reorganization of the PHS and a transfer in administration to the newly formed Centers for Disease Control [CDC]. The original purpose was to gain a better understanding of late term syphilis, its symptoms, and its mortality rate. The men were recruited from the rural areas of Macon County and offered free medical care and a $50 burial fee (later adjusted for inflation) for their participation. In the interest of leaving the disease untreated, it was crucial to the design of the study that the participants were not regularly seeing other doctors. And, indeed, for most of the men, the doctors conducting the study became their only medical providers for the duration of the study: professional medical care was not widely available in the Depression-era South, and this was doubly the case for impoverished rural inhabitants. It is crucial to note, however, that the men were selected not just for their economic dependence, but for their race as well. As James Jones notes, the study's design was based in the understanding of medical science at the time that infectious diseases spread differently and evoked different severities of symptoms within different racial populations. This was regarded as particularly true for sexually-transmitted diseases, given the nineteenth and early twentieth century ideologies concerning unchecked black sexuality. Freed slaves had been described by one doctor as a "syphilis-soaked race." The PHS study was thus explicitly designed not just to study syphilis, but to study syphilis as a racialized disease.  

From the perspective of early twenty-first century bioethics, it is difficult to overstate the extent to which the participants were exploited. The men in question were

\[134\] Jones 17-29.
already an extraordinarily vulnerable population. As noted above, almost none of them had regular access to professional healthcare prior to the study. They were, by and large, impoverished sharecroppers and subsistence farmers, and many of them were illiterate. Doctors in the study diagnosed them with "bad blood," a Southern euphemism for a number of diseases, and told them the aspirin and iron supplements they were receiving were effective treatments for the condition. When one of the designers of the study insisted that they must offer some kind of treatment, doctors administered a partial round of treatments, nearly guaranteed to be ineffective. Even that was done at the reluctance of Dr. Taliaferro Clark, one of the principal designers of the study, who remarked: "It never once occurred to me that we would be called upon to treat a large part of the county as return for the privilege of making this study .... I am anxious to keep the expenditures for treatment down to the lowest possible point because it is the one item of expenditure in connection with the study most difficult to defend despite our knowledge of the need therefor."135 Further, even though few of the men had outside access to healthcare, the study administrators actively worked to deny them treatment, coordinating with hospitals and private doctors throughout the county to ensure that any of the men who sought treatment would be referred back to the PHS. Further still, syphilis is a deadly disease which posed a significant risk to the men's sexual partners and children, all of whom were ineligible for even the limited treatment offered by the PHS doctors.136

Judging such a study by the standards of its time, however, is somewhat more difficult. There were no institutional review boards or human subject committees to oversee medical research in the 1930s. As the story broke, defenders of the PHS were

136 Reverby, Examining Tuskegee, 1-7.
quick to point out that in 1932, the standard available treatments for syphilis were mercury and Salvarsan (arsphenamine). These treatments were both painful and highly toxic, and further still demonstrated only mild effectiveness. Generally, they were only prescribed in cases where syphilitic patients presented extreme symptoms and, given the expense, would have been unavailable to most of the participants. Additionally, the participants received free medical care for any other illnesses and ailments that arose during the course of the study. Finally, the burial fee, although nominal, was more life insurance than many of the men were able to otherwise afford.\textsuperscript{137}

Nevertheless, the lack of informed consent and participation here remains shocking. The participants were not apprised of any of the options or risks involved. While the benefits of participating in the study may indeed have initially outweighed the risks for some of the participants, this was not a choice they were presented with. Although treatment was painful and expensive, some individuals may have opted to seek it out had they been informed of the nature of the disease. In fact, one of the earliest findings of the study was that the rate of syphilis infection in Macon County was lower than anticipated and that the rate of men who had previously sought treatment was substantially higher than the PHS had estimated.\textsuperscript{138} If the participants had been properly informed about their conditions, they certainly could have taken measures to protect their spouses, sexual partners, and children from being exposed to the disease. Most damningly, the study continued for the better part of three decades after penicillin was introduced as a safe, effective, affordable treatment in the 1940s. No justification seems able to account for the study's continuation after that point. Indeed, several rapid

\textsuperscript{137} Jones 98-101.  
\textsuperscript{138} Brandt 24.
treatment centers were established beginning in the late 1930s as public health efforts to eradicate syphilis through outreach and subsidized treatment. To preserve the integrity of their "subjects," study doctors again had to actively intervene to prevent the men from participating.  

As details about the story were revealed in the popular press in 1972, it became apparent that the study was not a secret within the medical research community – indeed, at least thirteen articles about the trial had been published in well-respected medical journals while it was running. The earliest of these was published in 1934, and follow-up papers appeared every few years. This was particularly damning not just for the doctors immediately administering and participating in the study, but for the medical community as a whole. The lack of any significant response at all from medical professionals suggested complicity with the racial logic of the study, or, at a minimum, a callousness towards its participants. Only one CDC official – Peter Buxtun, – raised any official protest about the study over its forty year duration. After his protests were ignored or rebuffed from 1966 forward, he eventually alerted the Associated Press to the details of the story in 1972.

Almost immediately following the revelation of the study in the popular press, a number of misunderstandings began circulating around it. The most prevalent of these was that the participants were deliberately infected with the disease. While this was not factually accurate, Wasserman, Clair and Flannery note that it has been remarkably

139 Jones 161-163.
140 Note, however, that the PHS did deliberately infect prisoners, soldiers, mental patients, and female sex workers in Guatemala in a separate experiment from 1946-48, conducted by one of the doctors involved in Tuskegee, no less. This was not public knowledge until 2010, however, and is unlikely to be a major contributing factor in the allegations about Tuskegee, even though it has rather disturbingly confirmed the bioethical ideological framework (or lack thereof) of the PHS in the midcentury, which held bodies of color as expendable in the pursuit of medical knowledge. See Susan M. Reverby "'Normal Exposure' and
persistent, even being repeated in major media outlets into the twenty-first century. Further, they contend that, along with other factual errors, the rumor of deliberate infections has been a significant factor in sewing distrust of the medical establishment among African Americans. Wasserman et al. focus on the factual inaccuracy of the statement, and argue that observers and critics need to be more careful with their language when discussing the events, for risk of further discouraging African Americans from seeking medical treatment. While it is difficult to argue with the notion that one should be certain of one's facts before repeating them, this focus on accuracy ignores the cultural imaginary in which such a rumor operates. Put simply, the very fact that the rumor has persisted for this long, in the face of repeated correction, speaks volumes about the perception of the relationship between the medical science establishment and African American communities. As Susan Reverby argues, Scholars who wish to debunk the myth of deliberate infection in the study in Tuskegee can acknowledge that myths do express some basic realities …. In a highly racialized and racist country, the idea that government scientists – drunk on their power over trusting sharecroppers in need of care – would deliberately and secretly infect black men with a debilitating and sometimes deadly disease seems possible …. To assume the men in the study were infected, rather than watched for decades, appears to make the racism worse, although it is the very ordinariness of the withholding of treatment that ought to frighten us more.


141 They record the rumor being repeated, as fact, by Bill Maher on his talk show Real Time with Bill Maher as recently as 2005. Wasserman 177–180.
Further, although Wasserman and his colleagues attempt to avoid this particular pitfall by noting that fifty-nine percent of whites in one study also believed the rumor, the frequent emphasis on correcting factual errors often works to establish a divide between "black folklore" and "white science," in which African American rumor mongers, rather than the researchers who commit such atrocities, are at fault for the mistrust of medical researchers.

As noted above, the Tuskegee study was an explicitly racial project from the start. However, it is important not to reduce the circumstances to a simple racial binary. Much of the discussion about the study in the weeks following its exposure centered on the role of both black individuals and largely black institutions in either assisting or condoning the study. The role of the Tuskegee Institute, a historically black college with the distinguished history of having Booker T. Washington as its first principal, was particularly contested. Administrators were quick to distance the school from the experiment, asserting that the Institute had not been directly involved in or had immediate knowledge of the study since the early 1940s, before penicillin became a viable treatment. However, the Institute's facilities were regularly used by the doctors conducting the study, with the knowledge of the Institute and thus presumably their tacit consent, as recently as early 1972. Additionally, a number of black doctors in Macon County were well aware of the study, and dozens of black medical interns had assisted with the annual "roundups" of the participants over the years. Of particular interest to the popular press was Eunice Rivers, a black nurse who had been one of the longest-term employees of the study. Numerous doctors and administrators in the PHS had praised her

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143 Jones 208.
over the years, suggesting that the study would not have been possible without her
tireless efforts and the personal relationships she developed with the participants over the
years. As the story unfolded in the press, one of the central concerns became the
participation of black nurses and doctors.

The state response, however, quickly returned to treating the study as the product
of a neat racial divide. Dr. Merlin Duval, the Department of Health, Education, and
Welfare official charged with organizing the investigation, chose Broadus Nathaniel
Butler, a black educator and president of Dillard University, to head a nine-member
citizen panel, five of whom were black. As Jones notes, "The racial composition of the ad
hoc advisory panel was designed to allay fears of a whitewash. 'I wanted a panel that
would be sympathetic to the public point of view rather than the scientific or factual point
of view, so I loaded it with angry blacks,' Dr. Duval insisted a year after forming the
panel."144 The desire to avoid a whitewash was certainly understandable, although it was
unclear whether Duval was concerned about the whitewash itself or the political fallout.
Regardless, his statement was telling in that it established "scientific or factual point of
view" in direct incompatibility with and opposition to both "public point of view" and
"angry blacks." African Americans, here, were both cast as intrinsically emotional and
rendered outside of "science," even when they were highly qualified members of a
government inquiry.

Charlie Pollard, one of the survivors of the experiment, soon retained the services
of Fred Gray, a prominent civil rights attorney who had defended Rosa Parks and Martin
Luther King, Jr. during the Montgomery bus boycotts. Gray developed a case on behalf
of all the survivors and the victims families to gain financial compensation from the PHS.

144 Jones 210.
Notably, however, his legal case took an ideological shape remarkably similar to Duval's: he presented the study as a case of white government scientists exploiting vulnerable black communities. In the suit, he named multiple government agencies, the Milbank fund, and individual PHS officers as defendants, but did not name a single predominantly black institution or any black physicians. He further alleged that the program constituted "controlled genocide." Undoubtedly, this was a successful legal tactic: he quickly won an out-of-court settlement for $10,000,000 from the federal government. However, it had the additional effect of reifying the notion that the primary function of blackness in relation to science was as a provider of vulnerable bodies.

The public firestorm that surrounded the exposure of the experiments spurred a rapid response from Congress, as well. Within six months, Senator Edward Kennedy – one of the foremost Congressional voices on health care – called hearings to investigate human experimentation in medical research. Strictly speaking, the hearing was not limited to Tuskegee, but concerned all public funding for medical research involving human subjects. As Jones writes, "Testimonies were received from top-ranking government bureaucrats, leading scientists, high-powered academics, and concerned citizens on topics ranging from psychosurgery to involuntary sterilization." Testimony on Tuskegee comprised the bulk of the hearing, however, including the testimony of two survivors of the experiment. Following the hearings, Congress passed the National Research Act in 1974. The act created the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research to oversee and create guidelines for any medical or behavioral research with human subjects. Notably, the act specifically

\[145\text{ Jones 214-217.}\]
\[146\text{ Jones 213.}\]
called for civilian oversight and the inclusion of humanists and philosophers on the board alongside medical scientists and biologists.

Of course, the legislative response certainly did not allay fears or suspicions in all quarters. As previously discussed, the Tuskegee experiments left a lasting scar in the relationship between African American communities and the medical science establishment. Scholars and journalists have attributed the Tuskegee study as a contributing factor for the reluctance of African Americans to participate in medical research on a variety of issues from diabetes to HIV and cancer. Recently, there have been some quantitative analyses that suggest that previous qualitative research has overemphasized the role of Tuskegee in fostering that distrust.\textsuperscript{147} However, as one very visible and relatively recent entry in a long history of abuse at the hands of biologists and medical researchers, there is little doubt that it has contributed to a wider cultural skepticism about the commitment of medical science to the welfare of African Americans.

Without a doubt, the Tuskegee experiments left a tragic legacy and further highlighted horrific divisions in American society along racial and class lines. However, by exposing the persistence of race as an organizing force in state research and the unconscionable results thereof, Tuskegee also provided fertile ground for a popular critique of state scientific enterprises. At least one Afrofuturist artist, Sun Ra, would not

\textsuperscript{147} Dwayne T. Brandon Lydia A Isaac, and Thomas A LaVeist argue that the impact of Tuskegee itself as a singular event cannot be detected quantitatively, but that "race differences in mistrust likely stem from broader historical and personal experiences." "The Legacy of Tuskegee and Trust in Medical Care: Is Tuskegee Responsible for Race Differences in Mistrust of Medical Care?" \textit{Journal of the National Medical Association} 97.7 (2005): 951–956. Print. Similarly, B. Lee Green, et al. found in a phone survey with over 1100 participants that black respondents were not necessarily less likely to participate in medical studies, but that they expressed 1.8 times greater fear of biomedical research. "The Tuskegee Legacy Project: Willingness of Minorities to Participate in Biomedical Research." \textit{Journal of Health Care for the Poor and Underserved} 17.4 (2006): 698–715. Web. 6 Mar 2012.
only take up this critique to question the motives of scientific researchers, but would further demonstrate the grave consequences of unfettered rationalism. Mobilizing the tropes and rhetoric of black subjugation and trauma dating back to the Middle Passage towards a quite different discursive end, Ra positioned himself as both a master mythologist and a wielder of scientific expertise. In his own terms, he became a "MythScientist," capable of creating a new reality through his union of the rational and the mystic.

**Sun Ra and the Myth-Science Arkestra**

Although it is only recently that scholarly attention has returned to Sun Ra, he was, without a doubt, a culturally significant figure in his own era: he had an incredibly prolific career, with at least seventy studio albums and countless live recordings stretching over five decades. Jazz critic Robert Campbell has argued that Sun Ra may have one of the largest discographies in jazz history.148 George Lewis has noted that, although there was some contention among younger musicians about the directness of his impact, it is difficult to deny the significance of Sun Ra in the theatricality of the avant garde jazz scene in the 1960s.149 Pinnacles of modern jazz, from Miles Davis to John Coltrane, have cited him as a major influence on their own artistry. Despite this, he remained a consistently marginal figure during his own life, the quintessential

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148 The bulk of his recordings, however, were released in either very small runs of 50 or less, or never commercially released at all. For an extremely detailed accounting of Ra's discography, see: Robert Campbell and Christopher Trent. *The Earthly Recordings of Sun Ra*. 2nd ed. Cadence Jazz Books, 2003. Print.

underground musician, maintaining his Arkestra on a shoe-string budget even during some of their most successful years.

The man who would later become Sun Ra was born Herman Poole Blount in 1914 in Birmingham, Alabama. Although he later claimed he was an angelic being originating from Saturn, his sister recalled a distinctly more terrestrial origin: "He was born at my mother's aunt's house over there by the train station…. I know 'cause I got on my knees and peeped through the keyhole. He's not from no Mars."\(^{150}\) His father left the family when Ra was very young, and he was raised primarily by his maternal grandmother and great-aunt. In later life, he would state that he had never called anyone father or mother, and that as a result he did not have the same "programmed" mind as others. In this sense, his oft-repeated statement "I've never been part of this planet," speaks quite literally to his isolation as a child.

The Birmingham of Sun Ra's childhood was part and parcel of the Jim Crow South. He attended segregated schools through high school, and the downtown area even had a customary separate shopping day for black consumers. He had little exposure to whites or white society until, as a teenager, he began performing music professionally for white social clubs. As Szwed notes, however, Birmingham was also home to a growing urban, black, middle class population. Much of Ra's exposure to this aspirational class was also through his early professional performances. Black orchestra performers – whether at white or black gatherings – were expected to dress in lavish suits and tuxedos.

with all the trappings. Undoubtedly, this emphasis on the theatricality and ritual of the secret societies had a profound impact on his own stage presence later in his career.\textsuperscript{151}

Following high school, Sun Ra attended the Alabama State Agricultural & Mechanical Institute for Negroes. As with his secondary schooling, Alabama A & M was modeled after Booker T. Washington's call for greater technical and vocational training for freedmen and their descendants. As such, music was not a particularly prized course of study at either location. Nevertheless, he was invited to A & M as part of an effort to form the school's first official band, and attended on a musical scholarship. However, while his formal studies were in music, during this period he spent a great deal of time in the library and read extensively – including popular science magazines and science fiction, in addition to music history, English literature, and religious texts.\textsuperscript{152}

It was also at A & M that Sun Ra first became aware of his extraterrestrial origins. He had a vision in which "space men" contacted him and:

They wanted me to go to outer space with them. They were looking for somebody who had that type of mind …. I'd have to go up with no part of my body touching outside the beam, because if I did … I wouldn't be able to get that far back …. It looked like a giant spotlight shining down on me, and I call it transmolecularization, my whole body was changed into something else …. Then I landed on a planet that I identified as Saturn …. [The space men] wanted to talk with me. They had one little antenna on each ear. A little antenna over each eye …. They would teach me some things that when it looked like the world was going into complete chaos, when there was no hope for nothing, then I could

\textsuperscript{151} Szwed 9-16.
\textsuperscript{152} Szwed 21-28.
speak … and the world would listen …. Next thing, I found myself back on planet Earth.\textsuperscript{153}

There is some contention around the timing of this experience – none of Ra's friends or colleagues recall hearing this story before 1953. Additionally, sometimes during a retelling he would say he was living in Chicago when this event occurred, and he did not move there until 1946. But Ra also frequently related a specific anecdote in which his roommates at A & M mocked him for a diary entry about the events in 1936, which suggests that he had already been recording at least some portions of the vision at A & M.

From Birmingham, Sun Ra moved to Chicago in 1946. The Chicago of the late 1940s and early 1950s was a hotbed of black religious and philosophical movements. Street corner preachers represented a broad ideological spectrum, from Baptists to Garveyists. The Nation of Islam [NOI] headquarters were located in Chicago, and NOI speakers were a common sight on the South Side. As John Corbett notes, by the early 1950s Ra became the center of an intellectual group, which later dubbed itself Thmei Research. Ra, along with Thmei, began distributing his own broadsheets espousing a wide range of spiritual, political, and philosophical concepts, which offer some of the earliest written records of Ra's philosophy. These broadsheets sometime read as lengthy polemical statements, as poetry, or as a series of questions and answers, but most employ a set of intricate etymological tactics, drawing on the Bible and other texts, isolating individual words and performing letter substitutions or calculating numerical values for letters and words to draw out associated meaning. Of the broadsheets that have been preserved, many of them deal with race, the decadence of American life, and the failures of America as a nation to accept African Americans as full citizens or human beings.

\textsuperscript{153} Szwed 29-30.
The racial construction at work in these broadsheets is complicated by Ra's own identification. As Corbett notes, Sun Ra was presumably writing for and speaking to an exclusively black audience during his early years in Chicago. However, although Ra writes extensively about Negroes and Negro leaders, he always does so in the third person, at a remove. Further, by 1953, he was also claiming that not only was he not a Negro, but that he was a member of an angelic race from Saturn. In one tract, called "Negroes are Not Men," he writes "NEGROES WONDER WHY THEY ARE NOT TREATED LIKE MEN SINCE IT IS SAD 'ALL MEN ARE CREATED EQUAL'. THE ANSWER TO THAT QUESTION IS THAT NEGROES ARE NOT MEN. NEGROES DO NOT BELONG TO THE RACE CALLED MAN…….. THE TRUTH IS THAT NEGROES ARE HUMAN BEINGS." While the first part of this statement – that Negroes are not men – might be in accordance with his own alien identification, the second portion is explicitly at odds with it. The tracts frequently condemn humanity as an ontological category, suggesting that they have failed to live up to their holy potential. Kodwo Eshun writes that Ra and other artists of the "Postsoul Era," have "been characterized by an extreme indifference towards the human. The human is a pointless and treacherous category." In this sense, identifying Negroes as human beings is not necessarily indicative that he counted himself among them.

While Sun Ra had cultivated a number of rehearsal and performance groups during his time in Birmingham, it was not until he moved to Chicago that he founded the

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154 Sun Ra and John Corbett. *The Wisdom of Sun-Ra: Sun Ra's Polemical Broadsheets and Streetcorner Leaflets*. Chicago: WhiteWalls, 2006. Print. 76. Note: Given Ra's particular attention to and use of the structure of language, the transcriptions here preserve the original punctuation, capitalization, grammar, etc. to the best of my ability, even where they differ from standard English.

group he would lead for the next forty years: his Arkestra. Ra originally called the group the "Arkistra," in both a play on the spelling of orchestra and as another of his linguistic exercises. "Ar" is, of course, "Ra" in reverse, marking both the beginning and end of the name, and "kist" he said was short for "Sunkist" or the Sanskrit word kist, meaning sun beam. Over the next thirty-five years, the band would take on a host of different names, including the Intergalactic Research Arkestra, the Solar-Hieroglyphics Arkestra, the Spaceage Jetset Arkestra, and the Myth-Science Arkestra, among dozens of others. Ra said that the changing names reflected their changing musical interests, as well as the current "dimension" in which they operated. While the musicians in the group rotated in and out, several of the core members, including noted saxophonist John Gilmore, remained with the Arkestra through the remainder of Sun Ra's career.

Additionally, his musical performances began to change during this period, becoming increasingly modern and abstract. In Birmingham, he had arranged some modernist pieces which he played privately with a rehearsal band, but most of his public performances, including those of his own arrangements, were in more traditional jazz formats like swing and ragtime. He grew bored with these styles, however, and his music in Chicago became substantially more avant-garde. He began incorporating electronic keyboards and electronic bass in his arrangements, which ethnomusicologist David A. Martinelli argues may have been the first use of electronic instrumentation in jazz. He even included homemade instruments, which Szwed has noted took on a mythos of their own.

156 Szwed 93-96.
157 Although Ra died in 1993, as of this writing the Arkestra is still performing under bandleader Marshall Allen, who joined the group in 1955.
own, renamed as the "flying saucer, lightning drum, space gong, space harp, space-dimension mellophone, space drum, space bells, space flute, space master piano, intergalactic space organ, solar bells, solar drum, sunhorn, sun harp, Egyptian sun bells, ancient-Egyptian infinity drum, boom-bam, mistro clarinet, morrow, alto sax, spiral percussion gong, cosmic tone organ, dragon drum, cosmic side drum, and tiger organ."  

With business manager Alton Abraham, Ra founded the record label El Saturn Research in 1957, which became the primary publisher and distributor for Ra and the Arkestra. The label's first release, *Super-Sonic Jazz*, set the pattern for much of their recording history. The records were printed in extraordinarily small runs, ranging from as few as twenty to a large run of one hundred-fifty. The company did not advertise or publicize the records, apart from the Arkestra's live performances, and releases were only available through direct mail order. As there were so few copies created, El Saturn could not guarantee the availability of a particular record, and order forms included space to list up to five choices, should the requested item be out of stock.  

While *Super-Sonic Jazz* still featured vestiges of both big band swing and conventional bop – including a catchy, rhythmically coordinated brass section and fast chord progressions on piano, respectively – it also laid the ground for much of the Arkestra's unique sound that Ra was already calling "space music." In the opening track, "India," for example, solos on the aforementioned electronic keyboards provide an ethereal, meditative backdrop, while multiple, simultaneous percussion instrumentation creates a dissonant energy throughout the album. Although the album is largely instrumental, song titles like "Sunology" and "Portrait of the Living Sky" already evoke

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159 Szwed 95-96.
160 Szwed 168-170.
the science fictional themes that would dominate later releases like *The Nubians of Plutonia* and *Interstellar Low Ways*, aka *Rocket Number Nine*, both of which were recorded in the late 1950s, although they were not released until 1966.

It was also during the 1950s in Chicago that Sun Ra began requiring the Arkestra to wear elaborate costumes to their performances. When the group first formed, they played at clubs in the same upper-class, gentlemanly trappings, polished suits and tuxedos, that the performers of Ra's youth had worn in Alabama. The revised costumes began when Abraham, the group's manager, "bought them an old wardrobe from an opera company, one heavily stocked with capes, puffed sleeves, and doublets, and they began to dress for 'space,' though it might have seemed a space closer to *William Tell* than to Mars." Soon, however, Ra was purchasing fabric and designing clothes for the group, many of which were sewn by the members themselves. These revised costumes featured a mix of space age and ancient Egyptian elements, including pyramid shaped hats, miniature solar systems made of wire, and blinking lights sewn directly into the clothing. As band member James Jacson described it, "You could be something by dressing up, by taking a role …. You could be a myth. And yet we became uniform in the abstractness of what we were." Ra himself described the purpose of the space costumes: "In those days I tried to make the black people, the so-called Negroes, conscious of the fact that they live in a changing world. And because I thought that they were left out of everything culturally … I thought I could make it clear to them that there are other things outside their closed environment." Thus, the "space suits" were far more than just a gimmick,
but a mechanism to envision black people as outer space explorers, as direct contributors to and manipulators of high technology.

In 1961, Ra left Chicago for New York. Members of the Arkestra began living communally, an arrangement which became permanent upon their relocation to Philadelphia in 1968. During the 1960s in New York, the Arkestra pushed their musical style even further afield in what was dubbed their "Intergalactic" phase. As Martinelli describes it, Ra's music in this period "contains several pieces that are completely athematic and deal entirely with textures and different kind of sound combinations. In this period all of the musicians began to explore the complete range of sound possibilities on their instruments (or voices)." By the end of the 1960s, Ra's new compositions had virtually abandoned the influences of both swing and bop for abstract high modernism. A particular turning point came with *Atlantis: An Intergalactic-Space Travel in Sound* (1969). The title track, a twenty-one minute epic which occupies the entire B side of the LP, is a recording of a live 1967 concert at the Olatunji Center of African Culture in New York. The piece opens with a low, rumbling percussion set before breaking into slow, periodic electronic organ tones (from Ra's "Solar Sound Organ") reminiscent of sonar or radar beeps. This continues for nearly two minutes, before a clavinet – a klaxon warning – interrupts. The two electronic instruments appear to compete with one another, only occasionally overlapping at first, before escalating and merging into a cacophonous wall of sound that dominates the arrangement. This frenetic, overwhelming sonic force is broken by occasional rhythmic interludes until the last quarter of the piece, when the percussion reenters along with brass and woodwinds which sound a wailing lament.

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164 Martinelli 20.
165 Szwed 248.
against a series of long, deep chords from the organ. As a whole, it is a sonic narration of
the destruction of a civilization, the titular Atlantis, washed away in a flood of sound. The
mourning, however, curiously disappears at the end of the recording, as the organ
reverses to a set of upbeat chords, matched by the only vocals on the track chanting,
repeatedly, "Sun Ra and his band from outer space have entertained you here."

The final movement of *Atlantis*, from destruction to celebration, is best
understood in light of Sun Ra's perspective on the present state of contemporary
civilization. He was deeply critical not only of the state power structures, but of the
responses by black leaders as well. Much of his identification as a being from Saturn
stemmed from his deep loathing of life on Earth. In his own words, "I hate everyday life.
This planet is like a prison. I'm trying to free people. I've observed this planet from other
planets and I've experienced what I saw in my music."

166 For Ra music was not just a
metaphor or a way to talk about alternative states of being, it was a way to literally create
them for himself and his audiences. That the album cover for *Atlantis* featured destructive
beams emerging from the sun – the symbol he most closely identified with himself – to
flood Atlantis was no accident. He saw his role as myth-scientist to create a new, more
enlightened state of being for mankind, but to do so required the destruction of what was
already there. Rather than eschewing the mad scientist, he saw himself as one, here to re-
engineer planet Earth in a nobler image.

The fusion between ancient Egyptian and outer space costumes was mirrored in
the development of Ra's "MythScience" philosophy in the same period. For Ra,
mythology and science, as employed in the common parlance, represented two
incomplete systems of knowledge. Science, on its own, could speak of reality, but reality

166 As quoted in Szwed 364.
was a trap: "Those who live by reality are slaves of truth. It's a kind of narcotic … Truth can be bad … People have been misled, they're in deep ignorance, the more they learn the worse the planet gets." Reality, for Sun Ra, was a deeply limiting, painful, and oppressive place. On the other hand, myth offered the promise of impossibility: if reality and the realm of the possible represented everything that had been tried so far – to dismal effect – why not embrace the impossible? Notably, however, he did not simply describe himself as a mythologist, but renamed his Arkestra the "Myth Science Arkestra." Indeed, as the 1960s wore on, he expressed increasing dissatisfaction with the mythology of Egypt and turned in greater measure to the science fictional imagery of outer space voyages. Mythology was irrevocably tied to the past, literally to the prehistoric. Ra argued that blacks in America were products of mythology, without history – but this, too, was a trap, because they were stuck in someone else's myth, unable to recognize the reality around them. The alternative Ra proposed was "Myth Science," a mythology of the future, that removed the distance between the impossible and reality. Music, particularly his "space music," could bridge the gap: as Eshun notes, "Traditionally, 20th C [sic] science sterilizes all myth: myth starts where science stops. But the recording medium acts as an interface between science and myth." For Ra, collapsing these two into a single epistemological system – which is precisely what his music and stage performances aimed to do – was the only way to address the crippling pain of reality.

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167 Szwed 317.
168 Eshun 160.
In 1972, Sun Ra, working with director John Coney, filmed *Space is the Place*, which became arguably his longest lasting contribution to the emergent Afrofuturist aesthetic. Part music video, part blacksploitation film, and part philosophical exegesis, the film resists simple attempts at summation. Loosely stated, the plot follows Sun Ra as he returns to Earth to recruit people to colonize an idyllic, empty, alien planet through his Outer Space Employment Agency. The chief conflict centers on a feud between Sun Ra and a pimp, known only as The Overseer, who challenge each other for the loyalty of various residents of 1970s Oakland. The film concludes as Sun Ra leaves Earth with his chosen disciples. The Earth explodes after his departure, evoking, much more directly than *Atlantis*, the specter of planetary destruction.

The film opens with Ra's spaceship moving against a painted backdrop of stars. Arkestra vocalist June Tyson intones repeatedly "It's after the end of the world, don't you know that yet?" Sung from off-screen and with no apparent audience on screen, Tyson's lyrics serve as a direct address to the film's audience instead. The end of the world, here, is not a science fictional apocalypse, but something that has happened in the real-world audience's past: the wholesale destruction of a people via the Middle Passage. In the following scene, Ra appears, in his full Pharaohnic Arkestra regalia, on an idyllic, alien planet. His only companions on the planet are shrouded figures who have mirrors for faces. These mirror-men serve as a second direct address to the audience, calling the viewer to consider their own participation in the film. Through the remainder of the film, the mirror-men only appear, as dancers, in musical interludes which take place outside of
the diegetic time of the film's narrative, overtly interrupting the flow, emphasizing the construction of the film as myth.

Additionally, Ra is himself linked to the destruction of the world directly. An early scene in a 1940s burlesque club culminates in him playing the piano in an increasingly rapid and chaotic fashion, until he begins smoking. Glass objects in the room begin to burst, and the crowd erupts in panic as it flees towards the exits. As the room erupts in flames, a closeup shot highlights a falling disco ball before it shatters on the stage, foreshadowing the shattered Earth at the film's conclusion. Likewise, after Ra's spaceship lands in Oakland, a newspaper is shown with two legible headlines: "Ra Arrives! Mystery Spaceship Lands" and "Four Earthquakes in 24 hours." Ra is here not just to save the residents from imminent destruction, but is instead the harbinger of that destruction. The apocalypse, in this framework, is something to be embraced, rather than feared: a flood to wash away the poor "vibrations" on planet Earth, the "sounds of guns, anger, and frustration." The outer space exodus here mirrors the narrative of the Middle Passage, including its wholesale cultural destruction. Significantly, however, Ra positions himself as the agent of the Middle Passage rather than its victim, as the literal pilot of the ship. He invokes this legacy directly when asked what will happen if his chosen subjects do not want to return to space with him: "Then I'm gonna have to do you like they did in Africa, chain you up and take you with me." The Middle Passage is thus reconfigured here as a space of creative opportunity, a chance to begin anew outside the bounds of time and history.

Notably, the film collapses time in several significant ways. As part of his opening monologue, Ra states "Equation-wise, the first thing to do is to consider time as officially
ended. We'll work on the other side of time." Some segments of the film take place in the 1940s and others in the 1970s, but there is no apparent age difference in the characters who are shown in both timeframes. An additional framing device in which Ra and The Overseer play cards, takes place against a desert backdrop that appears to operate outside of time altogether. However, within the continuity of the film, events in these three time frames are causally related, with no apparent interruption between them. Similar to Ra's articulation of MythScience, which worked to erase the cognitive distance between prehistory, history, and the future, the film challenges "the present" as an ontologically fractured concept.

Throughout the film, Ra plays on several science fictional tropes, but infuses them with Afrodiasporic cultural elements. The alien, utopian planet in the opening scene appears modeled after ancient Egyptian aesthetics. When asked what powers his spaceship, he replies simply "music," which remains bewildering to the white NASA scientists throughout the film. For example, in his opening monologue, he says "We'll bring them here through isotopes, teleportation, transmolecularization, or better still, transport them here through music." Ra's casual mastery here of scientific terminology, much as his mastery over space travel, positions him as the ultimate scientist, even as he suggests that such knowledge is inferior to his capacity as a cultural producer.

Despite the science fictional elements, within the film scientists are displayed as a significant threat. Although the Overseer is the primary villain, it is two government agents who provide the most direct threat to Ra's plans. These agents dress and act like FBI agents, and are first featured in a scene listening to a wiretap of Sun Ra. This takes on a particular salience given Ra's involvement with the Black Panther Party at the time
of filming and their ongoing harassment by the COINTELPRO initiative. However, it is quickly revealed that they are not from the FBI, but from NASA: that is, they are rocket scientists. It is these scientists who not only attempt to steal Ra's spaceship, but torture him physically and ultimately shoot a black teenager in a failed assassination attempt. Midway through the film, the two agents visit a brothel. After the agents are unable to perform sexually, two of the women are heard laughing at them. In a scene of explicit sexual violence, the agents grab the women, throw them around by their hair, and slap them repeatedly in the face. The women are left in a bloody heap, as the agents leave the room smiling. State scientists, here, violently reinsert ownership of the bodies of women of color.

Further, The Overseer is himself positioned as a scientist throughout the film. Although the relationship is never spelled out explicitly, he appears to be pulling the strings of the NASA agents. Further, he appears himself as a scientist, when he takes on the trappings of a doctor midway through the film, including a white lab coat, stethoscope, and head reflector. We are presented with a series of eyeline match cuts between him and an electrocardiograph in the room, establishing a clear intimacy between The Overseer and high technology. When he callously laughs about his patient, radio personality Jimmy Fey, as "another dead nigger," the legacy of the Tuskegee experiments, news of which dominated the headlines during filming, is implicitly invoked. This link between scientists and racial violence thus takes on a particular salience in the film.

Additionally, the film engages in more overt critique of NASA's racial politics at several points. During the aforementioned brothel scene, a black prostitute states to one
of the NASA agents: "I was always given the impression that you folks down at the space service program just did not have any use for black talent." The agent responds "That's just not true… we've got a plan right now to put a coon on the moon by June." At another point, responding to an inquiry from a black teen about whether or not "whitey" is with him in outer space, Sun Ra responds "They take frequent trips to the moon. I notice none of you have been invited," clearly pointing to NASA's history of racial discrimination in its astronaut program. The phrasing of the question and response seems at first a clear allusion to Gil Scott-Heron's 1970 blues poem, "Whitey on the Moon." However, in marked contrast to Scott-Heron, who critiques the NASA's budget as a misuse of funds in the face of woefully inadequate antipoverty measures ("The man just upped my rent last night. /cause Whitey's on the moon/No hot water, no toilets, no lights./but Whitey's on the moon"), *Space is the Place* does not lament space exploration, but embraces it. The premise of the film rests on Ra as the ultimate MythScientist astronaut, whose methods remain incomprehensible to even the rocket scientists at NASA. Thus, much as with Ra's music, *Space* thrusts black agents into outer space not just as an imaginative future, but as a mythology of the present.

While *Space* trenchantly critiques state scientists, it also challenges any essentialist formulation of black identity. The film certainly gestures towards black nationalism, as the plot is explicitly framed as a journey to establish a "colony for black people… to see what they can do on a planet on their own, without any white people." The first interviewee at Ra's employment agency is a white scientist who requests to join Ra's voyage. Ra responds "You can get a job [with us], but being of the particular race you are…” Ra trails off, leaving the potential position of white applicants, at best,
unclear. However, we only see three individuals interview for his employment agency, and two (counting the scientist) are white. The only black applicant, a drug addict, is hardly a redeeming presentation of blacks in America, and he voluntarily leaves the agency for the same reason as the white scientist: Ra explains that they will not be paid. While we never see a complete gathering of the disciples who do accept his message, at least one of them is a Hispanic woman. Most jarringly, at the conclusion of the film, Sun Ra addresses Jimmy Fey, a black pawn of The Overseer's, saying "You cannot take the black part of you with you. I'll take the black part with me." He then splits Fey into two bodies, presumably his white half and black half, though the two are played by the same actor. The "white" Fey, dropping his African American Vernacular dialect for Standard American English, all the while inhabiting a black body, flies in the face of any simple claims of racial identity as a product of biology.

Moreover, even the racial violence and exploitation at the hands of white scientists takes place in the larger context of the opposition between Ra and The Overseer. Again, it is The Overseer, rather than the white NASA agents, who appears to be pulling the strings. In this light, the dynamic is shifted from a dualism between white scientists and black victims to one in which the struggle over scientific knowledge is one taking place within the Afrodisporic community. By the late 1960s, Ra was explicitly rejecting the methods of the Civil Rights Movement in appealing to white authorities for greater recognition. He said "At one time I felt that white people were to blame for everything, but then I found out they're just puppets and pawns of some greater force, which has been using them. And giving them money and giving them everything to make them feel, 'Oh well, I'm supreme.' It fooled them – made a fool out of them too – and also
made a fool out of black people. As an alternative, he argued for a spiritual and mental evolution within black communities to awaken and take control of their own circumstance, or in his terminology, to "create their own AlterDestiny."

**Conclusion**

As Kodwo Eshun notes, "Ra identifies with the Pharaohs, the despots, the ancient oppressors by seceding from America." He might well add to that list the scientist. Ra's careful efforts to dissect and reassemble language, his assertions that the proper tonal sounds can create a higher state of mind – labeling his band members as "tone scientists" – are all efforts to re-engineer reality. He condemns NASA but takes on their role as an outer space explorer. Not only does he re-narrate the Middle Passage, but he does so with himself as the captain of the slave trading ship. Ra maneuvers from mythology to science to history to religion and back, only to collapse each as an independent ontological category. Rather than espousing gibberish or a refusalist nihilism, however, this embrace of seeming contradictions is productive, conjuring an alternative utopian vision rooted in Afrodiasporic tradition and mythology.

In one particularly moving scene in *Space is the Place*, Sun Ra speaks to a group at an Oakland youth center. The camera cuts between him and the faces of the black teens, which gradually shift from mockery or bemusement to wide eyed awe as he speaks. Behind the teens, on the walls of the youth center, are large photographic posters of radical black leaders, including Huey Newton, Malcolm X, and Angela Davis. They

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169 As quoted in Szwed 312. Emphasis in original.
170 Eshun 154.
question his credibility, demanding to know how they can take seriously an invitation to
go to outer space. He responds:

How do you know I'm real? I'm not real, I'm just like you. You don't exist in this
society. If you did, your people wouldn't be seeking equal rights. You're not real.
If you were, you'd have some status among the nations of the world. So we're both
myths. I do not come to you as a reality, I come to you as the myth, because that's
what black people are: myths .... I come from a dream your ancestors dreamed
long ago. I come to you as a presence from your ancestors.

By framing the struggle for legal and material rights, and indeed his very existence, at the
level of myth, he violates the epistemological boundary between the two systems –
mythology and material empiricism. Neither, for Ra, offers a meaningful path forward.
The real is the realm of constraint and suffering, while myth is incapable of action.
Instead, his "myth-science" approach signals his favor for hybridizing the two, for
embracing myth as lived experience and vice versa, as an of an always partial and
historically contingent identity that becomes its own guarantor of negated authenticity – a
hypersoul as the ground for a critical utopianism.

Thus, Ra's movement between oppositional identities acts as the very creation of
his own "AlterDestiny:" a rejection of the inequities of the life he was born into in favor
of something far more beautiful. John Corbett writes that any serious consideration of
Ra's music and philosophy has to start with believing "that Sun Ra was not of this
world .... [B]ecause while this E.T. metaphor ... may indicate the insanity of its maker, it
also cuts back the other direction, suggesting the fundamental unreality of existence for
people imported into New World servitude and then disenfranchised into poverty.\textsuperscript{171} Ra's refusal to count himself human reveals the inescapability of his racial position while his insistence on his own impossible alien past demands that just such an escape has occurred. Ra's Afrofuturism refuses the neat dialectics of black/body/victim vs. white/mind/science to begin with. Instead, he manipulate sounds, visual symbols, and signs not just to imagine a world in which blackness is synonymous with science and high technology, but to create one.

Chapter 4: Of Hackers and Nerds

On the campus of U.C. Berkeley during the early 1970s, two shaggy-haired youngsters observe a conflict between protesting students and campus police. Rather than join in with the students, however, the two run in the opposite direction. Once they are safe, one of them says, "Those guys think they're revolutionaries. They're not revolutionaries, we are." As his partner looks at him in awe, the narrator reflects "Steve was never like you or me. He always saw things differently. Even when I was in Berkeley, I would see something and just see kilobytes or circuit boards while he'd see karma or the meaning of the universe." In this fictionalized account of Steve Jobs and Steve Wozniak's time at Berkeley, *Pirates of Silicon Valley* (1999) succinctly captures several key cultural mythologies surrounding the development of the Internet and the personal computer: it celebrates the triumph of individual genius over collective social activity, and fuses technological determinism with the Eastern mysticism of the 1960s counterculture.

*Pirates of Silicon Valley* was hardly unique, of course, in portraying Jobs and Wozniak as "revolutionaries." In this chapter, I argue that this discourse of technological revolution, particularly as it is embodied in the emergence of the twin tropes of the hacker and the nerd during the closing decades of the twentieth century, marked a significant turning point in the representation of American scientists by rendering them as distinctly private individuals. In contrast to midcentury representations of scientists which focused on their public roles (whether for good or ill), these "computer nerds" are inevitably cast as private citizens struggling against a malevolent or restrictive social order. As this became the dominant motif to represent the emergent technoentrepreneurial class, federal investments in computing technologies, corporate and university
partnerships in designing network infrastructure, and the global circuits of exploitative labor practices in microchip production were effectively banished from consideration in favor of a triumphalist neoliberal narrative in which these individualist computer nerds overcame all odds to become successful business magnates.

Delivering a concise history of the Internet is, to say the least, a difficult task. Nevertheless, several popular accounts offer a rough chronology as follows: beginning in the late 1960s, scientists and engineers, working under the auspices of the US Defense Department's Advanced Research Projects Agency, developed electronic packet-switching and the Transmission Control Protocol and Internet Protocol (TCP/IP). Collectively, these systems allowed any point in a networked terminal to transmit and receive data from any other connected point in the Advanced Research Projects Agency Network (ARPANET). With Congressional funding, these protocols were then used to build the National Science Foundation Network (NSFNET) to connect universities and facilitate public research. Finally, in the early 1990s, private industry was allowed to connect to and expand the existing infrastructure, facilitating its wide-spread adoption by businesses and home users. ARPANET and NSFNET were then subsequently dismantled, as commercial and non-governmental entities took the lead role in future development. Without the restrictions and limitations that the network be used only for research or governmental purposes, the immediate and massive interest from private parties fueled a cultural sensation and economic boom, ultimately flowering in a "marketplace of ideas."\(^{172}\)

However, the Internet is, by definition, an amorphous and highly heterogeneous technological system composed of a wide spectrum of physical artifacts and software. The physical components include everything from fiber optic and telephone lines to industrial networking switches and communications satellites to end-user devices like personal computers and mobile phones. The networking protocols and applications that run on top of these systems are at least as equally varied, consisting of the familiar World Wide Web and email protocols, but also of instant messaging, file transfer systems, encryption standards, remote device controls, and audio and video streaming formats, to name just a few. And, of course, this assemblage of technologies has both been employed by and subsequently influenced every imaginable form of human association or relationship ranging from political and military organizations to romance and family life. Thus, attempting to trace its formation in a neat path or to declare a single moment as the "birth of the internet" is surely a fool's task.

Donna Haraway, in her essay "A Cyborg Manifesto," described just such a heterogeneous state of being in her analysis of the cyborg, coincidentally published just as nascent efforts at commercial Internet access were underway. Haraway argued that by the late twentieth century, we were all already cyborgs: social, psychic, and technological beings made up of multiple, hybridized parts, each with separate and diffuse origins. The essay is a groundbreaking feminist work with implications about the relationships between epistemologies of gender, race, and technology that greatly exceed the scope of the present discussion. Significantly, however, she suggests that any system comprised of such diverse and multivalent components is highly resistant to a simple ontology, having

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"no origin story in the Western sense." Haraway goes on to critique certain strands of radical feminism (particularly those advocated by Catharine MacKinnon), for imposing a just such a singular, totalizing image of "woman" and "women's history" on the hybrid realities of lived experience. Ultimately, she contends that such an effort is one whose logical conclusion can only be to "erase or police difference," thus collapsing the complexities of history in the interests of political control, domination, and subjugation.\(^\text{173}\)

Haraway's attention to the connection between technology, teleology, erasure, and a drive for control is particularly salient here. The popular narrative of the Internet's origins described above traces a particular evolutionary arc, from defense spending to public research to private enterprise. In telling this story as a narrative of progress, that arc is offered as both beneficial and inevitable. By suggesting that one form inevitably gives way to the other, this narrative is able to foster seemingly contradictory ideological positions: on the one hand, it promotes the necessity of state bureaucratic management of and investment in scientific research, while on the other it celebrates the unparalleled abilities of unrestrained entrepreneurial capitalism. Simultaneously, through expounding this teleology of public research and private innovation, this narrative elides the contradictory realities of the microchip revolution and the dawn of the Information Age, which were equally dependent on a number of less glamorous or heroic factors: exploitative labor practices in the Global South, restrictive immigration policies in the United States, and bureaucratic corporatism.

In the years surrounding the Internet's transition away from a state-managed network, representations of computer scientists and engineers follow a similar trajectory. In the 1980s and 1990s, a recurrent trope, with echoes both in the popular press and in fiction, celebrated distinctly boyish young hackers and software developers rebelling against Cold War bureaucracies. In contrast with state-funded researchers, these highly individualistic and enterprising computer wizards were still shown as generally well-meaning, if not particularly concerned with public service. Their motivation for technological innovation was highlighted as stemming from a desire for profit, self-expression, or simple curiosity, rather than as an effort to improve the national quality of life. In these accounts, the primary images of computer scientists shifted to upstart entrepreneurs rather than state-funded lab technicians. Indeed, popular film and literature frequently featured young computer scientists in antagonistic tensions with state bureaucracies and even the national defense industry, one of the largest benefactors of the state's commitment to research in a previous generation. The decentralization and miniaturization of computers as artifacts – from room-sized servers and supercomputers to personal computers – was thus mirrored in the popular representation of computer scientists from university researchers and company men to independently-minded entrepreneurs.

Additionally, these popular images of computer scientists and techno-entrepreneurs offered a particular construction of a white, masculine identity. As discussed in previous chapters, scientists in other periods were certainly gendered and racially marked, but the reimagination of the computer scientist as a boyish "nerd" in 1980s and 90s worked to reify these markings through a peculiar kind of irony. While
one of the defining characteristics of the nerd in popular culture was his seeming
emasculcation, these narratives relied on underlying gender norms which rooted
and Weird Science (1985), the apotheosis for their male nerd protagonists lies with their
ability to grow beyond their social awkwardness and sexually conquer women. Similarly,
as the chief proponents of the liberating, disembodied nature of cyberspace, they seem to
promote a postracial or colorblind ideology, even while historical evidence suggests
marked racial divisions within the emergent symbolic economy. Thus, in parallel to
Haraway's accounting of the cyborg, I argue here that the textual collapse of the
heterogeneous, hybridized genesis of personal computing and the Internet to a question of
personalized genius and innovation serves a specific ideological function: it effaces the
logics of race, gender, and nation that the privileged positions of these very innovators
and entrepreneurs were dependent upon.

It is important to note, however, that in drawing these connections between public
policy, technological development, and popular representation, I am not attempting to
suggest a deterministic relationship between the three forces. Quite to the contrary, my
attention to the contradictory impulses at work in the Internet and its heterogeneous
origins is intended to subvert that deterministic impulse. Opening the Internet to private
interests did not necessarily need to lead to the computing industry's symbolic status as
the pinnacle of entrepreneurship. Indeed, if institutional policy or technology were the
only factors in the popular representation of computer scientists, we might have ended up
as easily with a mythology of the Internet that emphasized statist collectivism over
unchecked individualism. While the underlying technologies of the Internet could
theoretically have been developed under alternative institutional structures, the social, political, and ethical commitments of the military-industrial-scientific-state collaboration had a profound impact on the shape of the network that ultimately emerged.

Rather, my principal contention here is that the discourses of technoentrepreneurialism and nerd identity are mobilized in particular ways and for specific ends: to promote productive mythologies and political ideologies. Specifically, these images were a significant factor in advancing what Andy Cameron and Richard Barbrook dubbed "The Californian Ideology." In their seminal 1996 essay, they call attention to the public alliances between the ostensibly leftist industry leaders of Silicon Valley with leading figures of the New Right, such as Congressman Newt Gingrich. They suggest that the ascendant computing industry was dominated by a peculiar brand of libertarian economic philosophy merged with countercultural iconography. This odd philosophical admixture was made possible by an underlying belief in technological determinism: that the emerging information technologies of personal computing and the Internet, facilitated by free market economic policy, would inevitably lead to the social liberation championed by the hippie movement of the 1960s. Drawing on Marshall McLuhan's faith in the power of electronic media to overturn the social order, this "virtual class" restyled themselves as cultural artisans who needed to be free of burdensome government regulation so that they might birth an electronic agora, or a digitally reimagined Jeffersonian democracy.174

Of course, as Barbrook and Cameron aptly note, this faith in the free market is belied by the very industries the Californian Ideologues were championing. The early

components of the Internet were products of defense spending and the physical
infrastructure was subsidized by the National Science Foundation [NSF] for the first
twenty years of its existence. More broadly, they note that the economy of the West
Coast was essentially created through a heavy investment of federal defense dollars,
irrigation projects, and highway development. The selective vision of the California
Ideologues was not limited to their own dependence on government largesse, but also to
the less glamorous impacts of an unregulated market: "by championing [free market
capitalism], these techno-boosters are at the same time reproducing some of the most
atavistic features of American society, especially those derived from the bitter legacy of
slavery. Their utopian vision of California depends upon a willful blindness towards the
other - much less positive - features of life on the West Coast: racism, poverty and
environmental degradation.\textsuperscript{175}

**Institutional Roots**

The notion of computing or networking technologies as a hotbed of
entrepreneurial activity is a relatively recent one. As Lisa Gitelman describes it, the
history of the Internet begins with the "paper cards and bureaucracy" characteristic of
Cold War-era corporate and government research.\textsuperscript{176} Indeed, prior to the 1970s,
electronic computing was almost exclusively the domain, both ideologically and
economically, of large-scale corporate or government enterprises. The world's first
electronic general purpose computer, the Electronic Numerical Integrator and Computer

\textsuperscript{175} Barbrook and Cameron.
\textsuperscript{176} Lisa Gitelman. *Always Already New: Media, History and the Data of Culture.* Cambridge, MA: MIT
ENIAC, was developed to calculate artillery trajectories for the US Army.\textsuperscript{177} ENIAC, like its contemporaries and immediate successors, was large, expensive, and difficult to operate. When it was complete, it consisted of over 17,000 vacuum tubes and 70,000 resistors, and weighed in at twenty-seven tons. Later descriptions of it as "the size of a room," are actually something of an understatement: although technically true, the room in question was an 1800 square foot laboratory at the University of Pennsylvania. The initial development cost nearly $500,000. One of its first calculations – to assist with hydrogen bomb research at Los Alamos – required over a million IBM punch cards to complete. Of the 17,000 vacuum tubes, one would fail approximately every two days and require replacement.\textsuperscript{178} Needless to say, this was hardly viewed as a revolutionary technology for personal use.

Over the next two decades, significant advancements were made in scaling down both the size and cost of electronic computers, particularly with the use of transistors to replace the large, expensive and failure-prone vacuum tubes of earlier models. However, even by the late 1960s, these devices remained almost entirely restricted to government facilities, research universities, and large corporations. For example, the Programma 101, arguably the world's first desktop computer, was introduced at the 1964 World's Fair in New York with a price tag of $3,200 (equivalent to $23,000 today). The device, which

\textsuperscript{177} There is significant dispute about the first artifactual computer, as well as the relative merits of attempting to apply that label to any single device, among historians of technology. Mechanical computers – from the abacus to the slide rule – have existed for millennia. The ENIAC is generally considered to be the first complete device that matches the key criteria of modern computers: it was electronic, digital, and programmable. There are, however, several devices either immediately preceding or contemporary to ENIAC which also display one or more features of the modern computer, including the Atanasoff-Berry Computer, Konrad Zuse's Z3, and the British Colossus computers. Additionally, ENIAC's "reprogrammability" is a topic of some debate, as it required manual rewiring. For a general history, see Arthur W. Burks. "The Invention of the Universal Electronic Computer—how the Electronic Computer Revolution Began." Future Generation Computer Systems 18.7 (2002): 871–892. Web. 16 Jan. 2013.

stored programs on plastic cards, was capable of performing basic mathematical functions and printing the results to a roll of paper: perfect for corporate accounting practices, but still a far cry from the creative and social applications of the modern personal computer.¹⁷⁹

Indeed, most of the early efforts at networking computers were aimed precisely at making the processing power of these large, expensive machines available to geographically distant users. Even with the widespread implementation of transistors in the 1960s, computers capable of performing the complex operations required for military applications or researchers in the physical sciences were anything but mobile. They resembled what we would today call supercomputers: cabinets or rooms full of machinery linked in sequence. Remote terminals were developed to allow access to these machines, first from distant points of the campus or research institution, and then from across the country. These terminals, nominally rudimentary computers themselves, allowed users to access the central system's software to have it run a set of calculations, the results of which would be reported back to the terminal. Timesharing protocols were quickly implemented, such that researchers would schedule hours in advance when they had exclusive access to the central machine. However, these terminals were linked via simple "star" networks: i.e. each dedicated terminal could only access a single central computer. To access a different machine, one would have to move to a different terminal.¹⁸⁰

For most university researchers or corporate users, this was not a significant concern at the time, as they rarely had access to more than one central computer to worry

about. However, computer scientists in the Defense Department had both their own installations and access to university machines scattered across the country to navigate. According to Robert Taylor, the head of ARPA's Information Processing Techniques Office at the time, the idea for what would later become ARPANET came to him in late 1965 as a result of trying to manage these separate networks and terminals: "For each of these three terminals, I had three different sets of user commands. So if I was talking online with someone at SDC [Systems Development Corporation] and I wanted to talk to someone I knew at Berkeley or MIT [Massachusetts Institute of Technology] about this, I had to get up from the SDC terminal, go over and log into the other terminal and get in touch with them. I said, oh, man, it's obvious what to do: If you have these three terminals, there ought to be one terminal that goes anywhere you want to go where you have interactive computing. That idea is the ARPAnet [sic]."181 Over the next few years, Taylor's office at ARPA worked on developing and implementing a multi-point, distributed network which would allow a user connected by a terminal at any point to reach any other machine on the network. Research and implementation of the network was contracted out to a private firm, Bolt, Beranek and Newman [BBN], with the aim of connecting universities and Defense Department installations with geographically distributed researchers. The initial system, which connected three computers in California with one at the University of Utah, was online by the end of 1969. By the following year, it reached the East Coast with a node at BBN's offices in Cambridge, Massachusetts, and by the end of the next decade, over 200 nodes around the globe were connected.182

182 Abbate 60-62.
Importantly, however, the institutional aim of this project was not to offer a general communication infrastructure, but to lower the cost of access to expensive processing power. As Janet Abbate notes, "the rationale for building the ARPANET focused on providing access to computer resources, not people." However, communication and collaboration among network users was soon one of the most appealing features of the new network. Email, developed by BBN as an afterthought and initially named "mailbox," quickly came to be the most popular service offered by the network. Ostensibly, any use of the network that was not directly related to research or Defense Department business was illegal, but a nascent cyberculture formed almost immediately, with public discussions taking place over email distribution lists about everything from the latest networking technologies to popular music. Abbate argues that this is due in large part to the peculiar culture of ARPA. Despite being a wing of the Defense Department, ARPA featured few career military or governmental personnel, typically filling its ranks with researchers from academia and private industry. Additionally, in contrast to the secrecy that surrounds most military research, the agency (and particularly its information services wing, which housed ARPANET) generally encouraged publication and information sharing with the wider scientific community.

Nevertheless, as a product of a Defense Department spending, ARPANET reflected a number of military institutional aims and priorities. For example, interoperability between heterogeneous hardware and software systems was a key concern for the Defense Department, which had previously experienced frustration with incompatible systems acquired from different vendors. Thus, ARPANET was built on

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183 Abbate 83.
184 Abbate 64-67.
layers, such that data could be routed between any two nodes or host computers without intermediary systems needing to interpret what they were passing along. Many of the key private contractors who provided hardware to the Defense Department were opposed to this design, as it undermined their ability to leverage proprietary designs and protocols to disincentivise users from switching vendors. Similarly, ARPA specifications required that network routing was distributed and adaptive. Rather than relying on a single central routing system, each node would need to maintain its own routing table, determining the fastest path to each other node in the system and adjusting for changes in traffic or network configuration, including unexpected outages.\textsuperscript{185} This was technically difficult to implement initially and costly to develop, but it met the military need for a highly reliable, efficient network. Additionally, the resulting structure allowed for a good deal of flexibility. For instance, in 1968 ARPA provided funding for the University of Hawaii to develop a packet radio network, out of its dissatisfaction with the limitations and inefficiencies of telephone communication. When completed, the new radio-based extension of the network, dubbed ALOHA.net, served the civilian needs of the University of Hawaii by connecting its seven campuses, it also allowed ARPANET to extend its reach to include direct access via radio from theaters of war in future conflicts.\textsuperscript{186}

Spurred by the successes of ARPANET, the NSF began subsidizing and building regional networks for research universities that were either ineligible or unauthorized to

\textsuperscript{185} One commonly told apocryphal story holds that this feature – referred to as 'routing around damage' – was specifically designed to make ARPANET resistant to nuclear strikes. However, the engineers of ARPANET have repeatedly stated that the real driving force here was the unreliable nature of the physical equipment at the time. Failures were common, and sometimes took hours or days to repair: having large portions of the network cut off from one another due to a single equipment failure would have severely compromised its efficacy. Despite the fact that the story about nuclear survivability has been debunked any number of times, it continues to resurface in popular histories of the Internet. See Barry Leiner, et al. "Brief History of the Internet." Internet Society. Web. 3 Jan. 2013.

\textsuperscript{186} Abbatte 51-53, 96-98.
access ARPANET. These networks employed the same basic technologies developed under ARPA, including layered communications, electronic packet-switching, and distributed routing. In 1980, the NSF allocated $5 million – an exceptionally large sum for a single foundation award at the time – to build a national civilian network. The result, the Computer Science Network [CSNET], came online in 1981 and offered email relaying services to universities nationwide, as well as access via a terminal interface to ARPANET.187 During the 1980s, the NSF began funding a number of large supercomputing centers and in 1985 they launched a new network, NSFNET, to connect the wider community of university researchers to these centers. The physical infrastructure for this network became the first backbone of the modern civilian Internet.188

Thus, like ARPANET before it, the professed institutional aims of NSFNET were to provide access for distributed end-users to utilize the significant processing power of centralized supercomputers, rather than communicate with one another. But also echoing the experience of ARPANET, communication and social services flourished on NSFNET. Email and message boards proliferated alongside the development and exchange of recreational software. Under a broad provision in the "Acceptable Use Policy" [AUP] that allowed for "Communication incidental to otherwise acceptable use, except for illegal or specifically unacceptable use," the service's Usenet discussion forums on topics as decidedly non-research-oriented as sex, science fiction, contemporary politics and popular television became one of its most widely accessed features. Thus,  

driven in part by the culture of its users, NSFNET both supported the state's institutional aims and allowed for public discourse and exchange.

However, the validity of commercial traffic over NSFNET remained an issue of contention. The AUP at times contained varying restrictions on advertising or sales, but made no restrictions on who could connect to the network. In fact for-profit entities were specifically allowed access on the provision that their use of the network was in the interest of "open scholarly communication and research." Further, where bans on specific activities, such as sales, were outlined, there was no enforcement mechanism specified. The initial grants and Congressional mandate to build NSFNET offered little guidance on the question of commercial use, because it was unclear in the early parts of the decade that commercial network access would be financially viable. However, by the late 1980s, a number of commercial computer networks were operational, and some of them were offering connections to regional Internet networks.

In 1991, two competing coalitions to create a national commercial network infrastructure emerged. The first, the Commercial Internet eXchange [CIX], was founded by a number of independent commercial Internet Service Providers [ISPs] to exchange traffic among one another without the restrictions of an AUP. The second was the offshoot of a creation of three NSFNET partners – Merit, IBM, and MCI – called Advanced Network Services [ANS] that built the basic infrastructure for NSFNET. Their new commercial subsidiary, called Commercial Plus Research [ANS CO+RE], planned to use that same infrastructure to carry commercial traffic. NSF administrators decided to allow ANS CO+RE to carry commercial traffic over the NSFNET backbone, under two conditions: 1) it did not diminish NSFNET's service, and 2) it recovered the average cost
of commercial traffic and distributed those revenues through an infrastructure pool to enhance or extend the network. The arrangement was met with skepticism from commercial carriers outside of ANS CO+RE, particularly due to the prior relationship between the NSFNET management and ANS. The arrangement also appeared to explicitly violate the AUP. The public image of this arrangement was further damaged by the fact that competing carriers first learned of the decision when ANS CO+RE began advertising and soliciting commercial clients. When the NSF subsequently offered to allow other commercial traffic over the network provided that it met the same conditions, they were initially rebuffed by the CIX. One member company issued a statement reading, in part: "To get real serious – [we] do not want to meet with NSF alone to discuss how we can take pecuniary advantage of millions of tax dollars. You need to discuss this with the community [in] an open manner, you need to fix the current wrongs – quickly. I want a level playing field."189

In light of this controversy, a subcommittee of the House Committee on Science, Space, and Technology held hearings to review the management of NSFNET as well as the manner in which it awarded its contracts and revised its policies. On the whole, the tone and tenor of the subcommittee's comments are quite favorable to the NSF staff and administrators, and they offer generous praise for the dramatic expansion of the network as well as lowering the cost-per-user. However, the subcommittee also charged the NSF's Office of the Inspector General [OIG] with conducting an internal review of NSFNET's processes for solicitation of services. The OIG's report, released the following year, is similarly laudatory of the project and quick to abuse critics of any notions of corruption or favoritism in the contract process. But the OIG also raises serious concerns

about the transparency and record keeping of the NSFNET administration's decision-making process. They note that while the decision to open the network to commercial traffic was, in retrospect, "not unreasonable," the record as to how or why they reached that decision is "utterly barren" of documentation apart from a single email which simply stipulated the conditions under which commercial access would be granted. The OIG further charged that the allowance of commercial access was almost certainly a significant enough change to require prior approval by the National Science Board. They also note that the AUP, since its initial implementation, had failed to meet the basic criteria of publication and time for public comment required by the Administrative Procedure Act, and suggested an immediate reform of agency policy to address these concerns.\textsuperscript{190}

In the interim between the Subcomittee hearing and the release of the OIG's report, however, the central issue of the controversy was rendered irrelevant. The same Subcomittee which held the hearings introduced and passed an amendment to the Scientific and Advanced-Technology Act of 1992, which altered the NSF charter to authorize it to connect research and education institutions to "computer networks which may be used substantially for additional purposes."\textsuperscript{191} In effect, this removed any question about the legality of using NSF funds to connect to or carry commercial traffic. The bill also paved the way for the privatization of the Internet's underlying architecture. The NSF refocused on high-speed connections between universities and research institutions, while several commercial carriers, including members of ANS who had entered the digital networking arena with NSF subsidies, took over the backbone routing

\textsuperscript{190} Review of NSFNET.
functions of NSFNET. The last of NSFNET's backbone was decommissioned in April 1995, and various aspects of governance for the network, such as authority over domain names and IP addresses, were gradually transferred to international non-governmental organizations.192

The Internet, then, has represented a mélange of public and private interests, institutional priorities and personal curiosities, and long-range planning and accidents of history since its inception. Often, these were the product of intentional collaborations for mutual benefit: public agencies contracting out or subsidizing research at private firms like BBN and ACN. At other times, as with the explosive popularity of email on a system that was not particularly intended for personal communication, these varied interests were orthogonal but relatively complementary. On occasion, the forces at work in the emerging network were even at cross-purposes. A desire to carry commercial traffic over equipment heavily subsidized by public research dollars may have been the most visible of these conflicts, but disparate values were present even in the basic architecture of the Internet. The mandate for interoperability, for example, directly undercut the ability for firms like IBM and Intel to profitably exploit technology patents. The point, then, is not that the Internet is wholly public or wholly private, but rather that it emerged as a product of the negotiation between these assemblages.

However, following the OIG's decision to open NSFNET to commercial traffic, the multifaceted origin and composition of the Internet was largely effaced in popular retellings. As Thomas Streeter writes:

One might have explained the internet's success in terms of its nonprofit origins and nonproprietary organizing principles; the principles of open cooperation that are to some degree built into its design and that have encouraged its rapid global spread arguably reflect the ethic of sharing and collective inquiry common to the research universities that fostered the internet's development in the 1980s …

[However,] Wired magazine, the libertarian Electronic Frontier Foundation, and similar organs of the computer counterculture offered us another interpretation: the internet was a triumph, not of nonprofit principles or of cooperation between government and the private sector, but of a kind of romantic marketplace entrepreneurialism – a "frontier." As this interpretation seeped into policymaking circles and eventually became the "common sense" of the day, any policy lessons that might have been learned from the internet's nonprofit origins thus have been roundly ignored. Since the early '90s, the only question has been how to completely commercialize the system, not whether or not to do it.¹⁹³

A key cultural force in enabling this transition was an emerging celebrity culture surrounding a core group of software-entrepreneurs-turned-corporate-moguls. Entering the world of computing from a significantly different trajectory than the Cold War bureaucracies of ARPA or the NSF, these entrepreneurs became the faces of the vaunted individualism of the Internet; in a word, they became the embodied representation of the personal in the "personal computer."

The Boys of Silicon Valley

In a bit of historical irony, the scale of growth of the Internet was almost directly paralleled by a diminishment of the initial need that drove its development. While ARPANET and NSFNET were focusing on connecting users to large, centralized machines, the possibility of distributed processing was moving ever closer to a reality. In 1971, Intel's 4004, the first commercially available microprocessor, offered the same processing power on a single chipset that would have previously required a cabinet full of equipment. Moreover, it did so at a cost of only $60.194 By the mid-1970s, the continued development of microprocessors meant that digital computing became economically feasible for small business or even personal use. Over the next decade, as the popular image of the computer shifted from the ENIAC-like megaliths to personalized machines, entrepreneurial software developers gradually supplanted scientists in government bureaucracies or large research institutions as the primary figures identified with technological innovation in the popular media. As their fortunes grew and they gained national attention, the representation of these entrepreneurs was initially strongly linked to that of the antiauthoritarian "hackers" in the hobbyist communities from which they emerged.

In January 1975, the cover of Popular Electronics featured the Altair 8800, the first complete kit for a home computer. The manufacturer, Micro Instrumentation and Telemetry Systems [MITS], hoped to sell a few hundred units. The 8800 still required substantial assembly – one advertisement in Radio-Electronics opens with the headline that "Building Your Own Computer Won't Be a Piece of Cake," and goes on to detail that the kit will take hours to assemble. In the initial release, the input and output of the

machine were limited to a row of switches and lights, respectively, both located on the
front panel. By entering a single line of programming at a time through the switches, a
user could program the lights to flash in sequence. The kit thus offered very little in the
way of utility, but its appeal to the electronic hobbyist community was undeniable: MITS
found themselves besieged by thousands of orders in the first months after the magazine's
publication. The electronic hobbyist community in the United States was already featured
regularly in national publications like *Popular Science*. But the radical success of the
8800 breathed new life into these communities, fostering the creation of dozens of home
computer clubs around the country and dedicated newsletters for tips and tricks for
modifying the computer or writing software.\(^{195}\)

As computer hardware became available to a much wider audience, more
efficacious and user-friendly software was required to manage that hardware. Many of
the most celebrated figures of the software movement over the next decade had
connections to the Altair and the enthusiast communities that formed around it. Bill Gates
and Paul Allen, for example, founded Microsoft in 1975 to develop and release a version
of the BASIC programming language interpreter for the Altair. Allen was working as a
junior programmer at Honeywell at the time, while Gates famously dropped out of
Harvard to work on the project. Steve Jobs and Steve Wozniak were both members of the
Homebrew Computer Club in Palo Alto, where they met and exchanged design and
programming tips with other members before launching their own product, the Apple
Computer, a fully assembled circuit board for the hobbyist market to compete with the

\(^{195}\) The Altair was not the first home computer kit to be offered commercially, but it was the first to draw
this degree of response from the hobbyist community. For more information on early entries into the home
computer market, see Zbigniew Stachniak. *Inventing the PC: The MCM/70 Story*. Montreal: McGill-
self-assembled kits like the Altair. This is by no means to suggest that software
development was limited to amateurs or budding entrepreneurs – large corporate firms
like IBM and Sun Microsystems, as well as traditional research universities like MIT and
Carnegie Mellon, continued to play substantial roles in both the theory and practice of
software. But the barriers to entry, in terms of both capitalization and professional
training, in software development were significantly lower than those in the design or
manufacture of computer hardware. As a result, a number of small firms, without
direct ties to the traditional business computing world, quickly rose to prominence in the
field.

As these efforts grew from hobbyist curiosities run from parents' garages into
successful multi-million dollar enterprises, the popular press was entranced by the
Horatio Alger-like narratives offered by the software moguls' biographies. In particular,
stories about the enterprising individuals leading these organization proliferated in press
coverage of the emerging field, often with as much emphasis on their "quirky"
personalities or social awkwardness as on their technological acumen. Their personal
characteristics quickly became substitutes for the companies they headed, with Microsoft
or Apple embodied in the visage of Bill Gates or Steve Jobs. Frequently, this use of
synecdoche was performed quite explicitly, such as one *New York Times* article that
notes: "To compete against sophisticated marketers like Lotus, Microsoft is also
undergoing a corporate makeover, trying to shed its 'techie' image in favor of a flashier
one. The corporate image perhaps is a reflection of Mr. Gates himself, who is a technical
genius but is much less outgoing than Mitchell D. Kapor [the chairman of Lotus

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Youth also became a central feature of any story about software enthusiasts and developers. A 1982 interview in the Christian Science Monitor with the eighteen-year-old president of the largest computer club in the country is fairly typical in its opening lines: "When interviewing the president of the widely respected, rapidly growing, phenomenally successful Boston Computer Society, it seems almost impudent to ask him point-blank: 'How old are you?" Particularly as the personal fortunes of industry leaders grew, journalists were quick to mention "multi-millionaire" and "25-year-old" in the same sentence.

Additionally, almost invariably, these entrepreneurs were presented as cultural outsiders, resisting traditional business culture or bureaucratic institutions. Headlines like "High-Tech Rebel" led into biographical profiles of industry leaders, while "computer revolution" became an inescapable part of the lexicon. Journalists frequently made mention of the interests of particular entrepreneurs – like Jobs and Lotus' Mitch Kapor – in Eastern spiritual and meditative practices and highlighted the relaxed and unorthodox work environments of the new software "campuses" at Apple and Microsoft. As the commercial personal computer market rapidly expanded in the early 1980s, more explicit connections were drawn linking the artifacts themselves to countercultural interests. A Newsweek cover story from 1982, for example, mentions that "John Cutler, design engineer for the Grateful Dead, uses an Apple II backstage to fine-tune the electronics during the rock group's performances. It can also serve a loftier purpose: the Rolling Stones have an Apple that helps their official biographer store information and write the

group's history." As at least a few of these hobbyists became the heads of corporate empires themselves during the 1980s, the revolutionary narrative was twisted and retwisted with the same cast playing different characters: the entire hobbyist community against the suits at IBM, the Homebrew Computer Club (including Jobs and Wozniak) thumbing their noses at Gates' demand that they stop pirating his Altair BASIC interpreter, Gates' decision to break with Apple and develop DOS for the IBM PC, Jobs ouster from Apple in 1985 (and triumphal return in 1996).

This outsider image was further reinforced by the hacker culture that surrounded computer enthusiasts. In the 1960s, the term hacker came into use at the MIT Artificial Intelligence Laboratory to describe anyone who was particularly skilled at electronic or computer engineering. In the 1970s, as the term was adopted by hobbyists like the Homebrew Computer Club, its general meaning shifted to software manipulation, although its primary connotation was skillfulness, not malice – a hack was a brilliant or efficient piece of code, regardless of its purpose. Although hackers represented a wide range of social positions – including computer scientists at the Defense Department and IBM – publications and communities that embraced the term began to cast themselves as anti-authoritarian. For example, the magazine *2600: The Hacker Quarterly*, first published in 1984, took its name from a signal designed to subvert long-distance telephone signals. The editor published the magazine under the pseudonym Emmanuel Goldstein, after the revolutionary icon from George Orwell's *Nineteen Eighty-Four*, and

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frequently published personal advertisements from incarcerated subscribers looking for pen pals.\textsuperscript{203}

Steven Levy's widely-influential 1984 tome, \textit{Hackers: Heroes of the Computer Revolution}, which offers both a history of hobbyist computing and an anthropological account of the community at the time, proposes a definition of the "hacker ethic" that neatly connects this anti-authoritarian posture to technologically determinist ideology that computers represented a social shift in and of themselves. He outlines six key features of the hacker ethic, including "All information should be free" and, significantly, "Mistrust Authority – Promote Decentralization." Explaining the latter point, Levy describes IBM as "a clumsy, hulking company that did not understand the hacking impulse …. All you had to do was look at someone in the IBM world and note the button-down white shirt, the neatly pinned black tie, the hair carefully held in place, and the tray of punch cards in hand." These were partnered with "You can create art and beauty on a computer," and "Computers can change your life for the better," which suggested that not only did computers enrich hackers' lives, but that "Like Aladdin's lamp, you could get it to do your bidding. Surely everyone could benefit from experiencing this power. Surely everyone could benefit from a world based on the Hacker Ethic. This was the implicit belief of the hackers."\textsuperscript{204} Levy thus positions the hacker ethic at the nexus of technical mastery and a particular kind of antiauthoritarian individualism. Under this world view, emerging digital technologies would allow for radically expanded power for individuals, provided they developed the skills necessary to put those technologies to work.

As the term hacking entered the popular lexicon in the early 1980s, it referred almost exclusively to the circumvention of computer security protocols, rather than the more diffuse sense of clever technical manipulation of any electronic hardware or software. One of the first uses of the word related to computers in North American journalism, for example, is an article from the *Globe and Mail* about "computer gangs" being pursued by the FBI. The article portrays the hackers largely as teenagers and youths, despite a brief description of John Draper,\(^{205}\) who was nearly forty years old at the time of publication, and goes on to suggest that "The typical hacker has been described as caring little for his appearance, tending toward long straggly hair, sometimes bound in a ponytail for convenience, a wispy beard, not because he grew it, but because he couldn't be bothered to shave, jeans, sneakers and wool plaid shirts. He probably is pale from spending so much time indoors, and likely wears thick spectacles, having strained his eyes from watching small green luminous letters on a screen, possibly since he was 11."\(^{206}\) Despite focusing on illegal activities, the press often qualified their descriptions to note that these were not necessarily undertaken with malicious intent. A contemporaneous *New York Times* article, for example, describes hackers as "technical experts; skilled, often young, computer programmers, who almost whimsically probe the defenses of a computer system, searching out the limits and the possibilities of the machine. Despite their seemingly subversive role, hackers are a recognized asset in the computer industry, often highly prized."\(^{207}\)

\(^{205}\) Draper, known in hacker circles by his pseudonym "Captain Crunch," was one of the most celebrated early "phone phreaks" who subverted the long-distance telephone system. He was first arrested in 1971, but continued to play a significant role in the hobbyist community, including the Homebrew Computer Club. See Levy 2010.


This connection between computer-savvy youth and anti-authoritarianism was cemented by a spate of popular films in the early 1980s. 1983's *WarGames*, for example, centers on David Lightman (Matthew Broderick), a bright high school student who is failing classes due to lack of interest. He hacks into the school computer system to change his grade, and does the same for his friend Jennifer (Ally Sheedy). In an attempt to find a group of computer games before they are released to the general public, he sets his computer to dial every phone number in the area code of the game developer. This leads him to stumble accidentally on a government supercomputer, the War Operation Plan Response [WOPR], which controls the launch sequences for US ICBM installations. David, however, does not understand what the machine is and only wants to access the games listed in its menu. After David hacks the system and starts a game of "Global Thermonuclear War," the false signals from the computer lead the military personnel to believe they are under attack from the Soviet Union. As the military prepares to launch its own missiles in retaliation, David is arrested by the FBI. The climax of the film comes when David escapes and seeks the aid of the exiled former military scientist, Dr. Falken (John Wood), who designed WOPR. The two work together to program the computer to play thousands of games of tic-tac-toe with itself. WOPR thus learns that some games are unwinnable and, comparing this to the likely outcomes of any nuclear engagement, cancels its attack.

The plot of Disney's *Tron* (1982) follows a parallel trajectory, albeit through a fantastical lens. The protagonist, software engineer Kevin Flynn (Jeff Bridges), is slightly older than *WarGames'* David. His former boss (David Warner) fired him after stealing the credit for several games that he designed. Flynn tries to hack into the company's
mainframe to prove his allegations, but is thwarted after his boss improves security measures. With the aid of his girlfriend, also a software engineer at the same firm, Flynn visits the firm to access the system. In the process, Flynn discovers that the (now self-aware) computer is attempting to seize control of defense systems at both the Pentagon and the Kremlin. To prevent Flynn's interference, the computer uses an "experimental laser" to abduct him into the computer system itself. In one of the earliest applications of computer generated imagery [CGI] on film, the bulk of the story takes place within the computer. Programs, rendered as likenesses of the people who created them in illuminated neon costumes, are forced to fight one another against highly imaginative science fictional backdrops. Flynn discovers that as a "user" (i.e. a programmer), he has heightened control over this environment, which he uses to assist a program by the name of Tron (Bruce Boxleitner) to overthrow the computer and return himself to reality.

Filmic hackers of the early 1980s, as well as their counterparts in popular journalism, were not typically shown as malicious nor even directly at cross-purposes with the Cold War bureaucracy. WarGames' conclusion, in fact, appears to endorse the military establishment's policy of Mutually Assured Destruction, as WOPR learns through its simulation that nuclear war is "a strange game" where "the only winning move is not to play." However, these hackers are also definitively not participants in those bureaucracies. It is their outsider status that enables them to save the day: the lumbering military and state agencies in these films, from the FBI to NORAD, remain blissfully unaware of the threats that surround them. It is only the intrepid young hacker, who is intentionally circumventing the security procedures in place, who is able to identify the problem and divert the computer to a more noble purpose. Their difference
with the establishment is largely one of ideology: hackers operated largely from an individualist curiosity, in contrast to the state's drive towards centralization and control.

As the decade progressed, however, popular images of computer enthusiasts and hackers began to take a marked turn. For example, at first glance, John Hughes' *Weird Science* (1985) appears to advance similar themes of young, outcast hackers at odds with the social structures around them, although with significantly more absurdism in its approach. The film follows two socially awkward teens, Gary (Anthony Michael Hall) and Wyatt (Ilan Mitchell-Smith), in their quest to use a computer to build the "perfect woman." In the opening scene, the boys are shown peeking at their female classmates performing gymnastics before their pants are pulled down by the school bullies. They face similar mocking from Wyatt's older brother (Bill Paxton), who attends military school. The two boys begin writing a computer program to simulate a virtual woman, but after they reach the limits of their home computer's processing power, they decide to hack into a government mainframe to make use of its superior hardware. Due to a bolt of lightning and some apparently supernatural circumstances, the program ends up creating a real, flesh-and-blood woman (Kelly LeBrock) who appears in their home and expresses that she "belongs to them." The boys name her Lisa, perhaps in an homage to the Apple computer of the same name. Lisa demonstrates a number of magic powers and encourages the boys to stand up for themselves and talk to girls. After a second encounter with the bullies, Gary and Wyatt agree to run the program to create girlfriends for them as well. However, the experiment goes awry and instead conjures a ballistic missile in their living room. After arranging a situation where the two boys have to stand up for two
of their female classmates (thus winning their affections), Lisa reverses the damage and erases the missile.208

Here, many of the same vestiges of representation are at work: we have a pair of teenage boys who intrude on a government system not out of greed or lust for power, but just so that they can better understand women. However, the boys are not just socially awkward, they are actively persecuted, both by the bullies at school and Chet, who, with his military school uniform, metonymically represents the armed forces. While earlier hackers certainly came into conflict with authorities – indeed, this was one of the defining features of their non-fictional coverage – it was specifically for their extralegal actions. By contrast, Wyatt and Gary's victimization and social awkwardness appear to exist in a closed loop: they are picked on because they lack social skills, and they lack social skills because they are picked on. Likewise, hackers in the press or popular film had never been oozing with machismo, but the fixation here on the boys' sexual competency, or lack thereof, is an important shift.209 They are no longer just countercultural hackers, but have fused with another cultural trope: the nerd.

Nerds 2.0

As Ron Eglash notes, access to a very particular kind of social capital in the early hobbyist circles was as much of a factor as technical expertise or start-up funds in the

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208 Both Hughes and Matthew Broderick would revisit the theme of teens using computers to beat the system, minus the overtones of sexual domination that run through Weird Science or the references to the military-industrial state that permeate both that film and WarGames, a year later in Ferris Bueller's Day Off (1986), when the title character (Broderick) hacks his school computer so that he can enjoy a leisurely day skipping school with his best friend and girlfriend.

209 Of course, it must be noted that the emphasis on sexual competency and the loss of virginity is completely in keeping with both John Hughes' oeuvre and with the slew of teen comedies and 'brat pack' movies following in the wake of Fast Times at Ridgemont High (1982) and Porky's (1982). What I am suggesting as shifting here is the connection between that trope and computer enthusiast culture.
success of the most visible software entrepreneurs. As he explains, "much of the ability of white software entrepreneurs appears to derive from their opportunities to form collaborations through a sort of nerd network." But if nerd identity was central to entrepreneurial success, what exactly are the characteristics of this formation? Eglash, referencing an interview with Samuel Delany, suggests that one starting point for a history of the American nerd would be with radio wireless clubs of the 1920s. The generally working-class, self-educated, white ethnic membership of these clubs offered alternative routes to technological exposure that challenged the class and racial boundaries of the largely WASP academic or "egghead" establishment. Following World War II, with the dramatic expansion of access to science and engineering education, and with the racial reconsolidation of whiteness through the mid-twentieth century, these two communities moved closer together in social status. Eglash' attention to the racialized and gendered performance of 'nerd identity' is quite astute, but he is perhaps a bit too quick to accept the nerd as a "subversive" image.210

The cultural lineage of the nerd archetype in American culture is at least as ambiguous as the etymology of the term itself. Like many slang terms, the precise origins remain opaque. The Oxford English Dictionary attributes the first use to Dr. Seuss' *If I Ran the Zoo* in 1950. But one hardly imagines that Seuss had bookish loners in mind when he penned a yarn about a zoologist who would collect "a Nerkle, a Nerd, and a Seersucker too."211 Various origins have been proposed for the term, from an association with the Brainerd Institute to a permutation of "nuts," as in crazy, although there is little solid documentation for any of these as the progenitor of the modern word. In any event,

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by the late 1950s it was used more broadly as a synonym for "square" or "uncool," although it was not heavily popularized until its frequent use on Happy Days (1974). Even in the late 1970s, there appeared to be significant confusion about the term: one letter to the Globe and Mail asked the editor to explain the term which had recently been appearing in its pages and linking her confusion to Germanic and Yiddish words like "kitsch" and "schmecks."²¹²

However, the primary use of the term in the 1960s and 1970s was largely about social ineptitude, having little to do with bookishness or intelligence and no particular connection to science or technology. For example, Potsie (Anson Williams), one of the characters most frequently identified as a nerd by his friends on Happy Days, was gullible and definitively "square," but not particularly bright or academically oriented. Likewise, Bill Murray and Gilda Radner appeared in a series of recurring sketches on Saturday Night Live beginning in 1978, playing characters called "The Nerds." While one sketch does feature their participation in a science fair,²¹³ it is clear that their defining features have less to do with technology and pertain much more immediately to their boorishness (particularly considering the comedic nature of the show). Nor are they cast as victims or as sexually inexperienced; while the pair's personalities are generally repellant, they frequently reference sexual encounters with one another. In an interview to publicize the show's return, Bill Murray explains that "Noogies are not the latest breakfast sensation from Battle Creek nor microscopic animals that can only be routed with foul-smelling ointments. Noogies are small indentations made in the skin of victims'

heads by rampaging nerds in high school." Note that it is the nerds applying the "noogies" here, where a decade later one would expect that formulation to be reversed.

In these earlier appearances, then, nerds were dialectically opposed to countercultural impulses: they were, by definition, "unhip." Throughout the 1980s, however, popular images of nerds came to be more and more tightly bound to computer savviness. With this, a curious merger took place between the nerd and the hacker. The emergent figure, Nerd 2.0, so to speak, existed as a kind of cultural paradox: profoundly uncool, like their nerd forebears, but also distinctly individualistic. Clad in the uniform of the IBM engineer with a slovenly twist – a button-down shirt complete with pocket protector, but slightly askew or untucked – the nonconformist stance of the hacker was reconfigured as social ignorance rather than resistance to centralized authority. Social awkwardness was transmuted to victimization at the hands of bullies and "jocks," as well as isolation from the opposite sex. This victimization became a defining feature of the nerd mythology, although it was always couched in triumphalism: every image of a nerd required a bully, but no story was complete until the nerd turned the tables on their aggressor. Sexual incompetency functioned quite similarly, as "the geek gets the girl" was presented as a surprise twist time after time, despite the fact that virtually every nerd-

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215 The attention to the linguistic evolution of the term here is not to suggest that reconceptions or reappropriations of the term are 'wrong,' or 'incorrect,' but rather to call attention to the synchronic dimension of the category. It would be foolish, for example, to assume that anyone who uses computers or the Internet in the twenty-first century is a 'nerd,' simply because these artifacts were associated with nerds at one time. Similarly, while Eglash' attention to the connection between software entrepreneurs and white ethnic radio enthusiasts of the early 20th century may have some anthropological merit, it is anachronistic to suggest that this connection lies in 'nerd identity.' In other words, it presumes a historical continuity, or rather imposes one, where it may not exist – removed from the specific historical context in which it is used, 'nerd' is the epitome of an empty sign. Questioning whether various historical figures were nerds (e.g. "Was Malcolm X a nerd?", which Eglash takes up, or the popular press' frequent invocation of Einstein as an early example of a celebrity nerd) is ultimately anachronistic – it may tell us a good deal about how we employ the category at the contemporary time, but does little to help us understand how these personages were received in the context of their own moment.
centric narrative from the period concludes in the same fashion. As in *Weird Science*, both victimization and isolation existed in a closed loop, with technical mastery as the cause of and solution to both problems.

There are few cultural sites where this narrative is presented in a more distilled form than 1984's *Revenge of the Nerds*. The film's protagonists, Lewis (Robert Carradine) and Gilbert (Anthony Edwards), are freshmen studying computer science at the fictional Adams University. The membership of the leading fraternity on campus, the Alpha Betas, is primarily made up of athletes from the football team who also appear to be quite wealthy – in contrast to the reality of economic stratification at most private universities, where athletics is one of the few venues open to lower-income students to gain access to scholarships. After repeated harassment at the hands of the Alpha Betas, Lewis and Gilbert lead a group of other social misfits to form their own fraternity. The bulk of the film consists of the nerds engaging in a series of back-and-forth pranks with the Alpha Betas. During a final confrontation with the Alpha Betas at a pep rally, Gilbert takes the stage and exhorts everyone in the crowd who has ever felt picked on or left out to join the nerds on stage in standing up to the jocks. Most of the crowd takes up the invitation, and the school collectively celebrates the nerds' triumph.

The film makes a concerted effort to link the nerds' social position to racial disenfranchisement, despite the fact that all but two of the nerds (Takashi, played by Brian Tochi, and Lamar, played by Larry B. Scott) are white. As the nerds first attempt to register a new fraternity, no national organization will accept their charter. They meet with U.N. Jefferson (Bernie Casey), the head of Lambda Lambda Lambda – a black fraternity – who initially refuses as well, until one of the nerds points out "Tri-Lamb's"
by-laws require that they be granted a probationary status. After Jefferson witnesses their taunting at the hands of the Alpha Betas, he grants them membership as a full chapter, as he identifies with their ostracized position in the university community. Given their status as members in a historically black fraternity, when the Alpha Betas leave a burning sign on their lawn that spells out "NERDS," the specter of racialized violence looms over the victimization the nerds meet at the hands of the Alpha Betas. By joining a black fraternity, the white nerds metaphorically cloak themselves in blackness to legitimize their suffering. With this in mind, Gilbert's invitation at the pep rally to everyone who has "ever felt stepped on, left out, picked on, put down" is not just a rallying cry for social misfits, but a suggestion that their suffering as socially awkward middle-class youth is equivalent to a history of racial terrorism and exploitation. And yet, the racial divide between the nerds and the rest of the Tri-Lambs is immediately reinstated when, in the very same scene, the black members of the national Tri-Lamb organization arrive and physically intimidate the Alpha Betas. The message is clear: white nerds may benefit from a comparison to black suffering, but black men will always inspire terror in white society, regardless of their social and economic status as well-to-do university socialites.

Similarly to the racial maneuvering, the film engages a paradoxical double move with regard to gender. The film's narrative centers on the creation of a fraternity, leaving little doubt that nerd identity, here, is a markedly male domain, but as with the two teens in Weird Science, the protagonists' initial romantic failures leave their masculinity in severe doubt. The nerds are shown to be woefully inadequate at navigating the sexually-charged sociality of university life. The situation begins to shift when they invite the Omega Mus, a sorority made up of socially awkward women as inept at performing
stereotypical femininity as the Tri-Lambs are with masculinity, to a party at their fraternity house. With the assistance of copious amounts of marijuana, a number of the Omega Mus make sexual advances on the Tri-Lambs, suggesting a reversal in traditional gender roles, as the nerds become the passive (if eager) recipients, rather than the initiators, of sexual contact. However, it soon becomes clear that the Omega Mus, with their faltering performances of femininity, are inadequate conquests for the nerds, who set their sights on the Pi Delta Pis, the sorority affiliated with the Alpha Betas. In one of the most noted scenes in the film, the Tri-Lambs conduct a "panty raid" on the Pi Delta house, shocking and disturbing the women while they are changing and showering. During the confusion of the raid, they install hidden cameras to capture nude images of the women, which they subsequently sell to win a charity fundraising event within the Greek Games. In an act of symbolic emasculation, the nerds also cover the Alpha Beta's athletic supporters in medicinal liniment, which causes extreme itching in their genitalia. Lewis, one of the two leaders of the nerds, then commits what is tantamount to rape when he "seduces" Betty Childs (Julia Montgomery), the leader of the Pi Deltas, by pretending to be her boyfriend, the leader of the Alpha Betas. The rape and the privacy violations are apparently justified at the same moment that the Tri-Lambs' sexual prowess is rendered complete: in the climactic encounter of the film, Betty accepts Gilbert's invitation to join them on stage, identifying herself as a nerd. Notably, Betty appears in all three of the film's sequels as Lewis' girlfriend and, later, wife. Rather than a gendered reversal or a celebration of alternative masculinity, then, it is clear within the film that nerd masculinity is predicated on heterosexual dominance over women.
Mixed messages surround the nerds' affinity for science and technology. On the one hand, the narrative structure makes it clear that this link is responsible for much of their social isolation. Their peculiar jargon and mannerisms of speech cut them off from the rest of campus, while their manner of dress – nearly exactly matching the "button-down white shirt, the neatly pinned black tie, the hair carefully held in place" description of the IBM engineer offered by Levy – marks them as hopelessly unhip. However, as the plot progresses, technological mastery becomes the key to their acceptance. U.N. Jefferson is particularly impressed by their use of hidden cameras in the Pi Delta house, which is one of the deciding factors in granting them full admission to Lambda Lambda Lambda. Likewise, the nerds impress the rest of campus when they win the Greek Games thanks to an elaborate New Wave musical performance created on their computers, highlighting the artistic and creative capacity of technology. The embrace of science and technology – presented here as central to their identity as nerds – is thus a problem containing its own resolution: it leads to their isolation and disenfranchisement, but is also the key to their apotheosis as university celebrities by the film's conclusion.

As a spate of films and popular media following the same essential formula of nerds standing up to and overcoming their detractors emerged in just a few short years, a growing but visible "nerd pride" movement emerged. Films like Ghostbusters (1984), Back to the Future (1985), The Goonies (1985), Real Genius (1985), Lucas (1986), Honey, I Shrunk the Kids (1989), and Assault of the Party Nerds (1989) all featured bookish boys or men trying to overcome their social awkwardness, generally in an effort to impress their female counterparts. Buttons declaring "Nerd Pride" and t-shirts emblazoned with slogans like "I'm a Nerd… and Proud of It" became popular consumer
items, while newspapers ran headlines like "The Nerds Were Right." Nerd proved to be a quite flexible category of identity in its appeal to a mass audience, although these various manifestations remained linked to a particular kind of intellectualism – generally rooted in science or technology – and social isolation. Significantly, however, the term carried specific racial and gendered connotations with it: while it was sometimes applied to women or people of color, it was generally noted how unusual this was. As late as 1993, for example, a New York Times article describing three female MIT students suggests an opposition between nerds and femininity when it reads "Ellen Spertus easily fits the 'nerd' mold. She is the first to admit that she isn't like a lot of women," and goes on to suggest that male nerds are a more common sight. Even less explicit was the attention to the class dimensions of nerd identity, but even with the proliferation of computing technology and the reduction in prices that came along, access to computers – the single technology so intimately linked with being a nerd throughout the 1980s – was hardly universal.

Although it received little comment at the time, Harvey Pekar, the author of the long-running autobiographical underground comic American Splendor, offered one brief, but largely prescient response to Revenge of the Nerds and the nerd pride phenomena. In the 1985 vignette, "Double Feature Part 2: Revenge of the Nerds," his friend (and recurring character) Toby Radloff drives hundreds of miles to see Revenge of the Nerds. Soon after, Pekar spots him wearing a button that reads "Genuine Nerd" and asks him if he identifies with the characters from the film. Toby explains that he does, and that the film made him proud because he was picked on for most of his life. Two weeks later,

after Pekar has seen the film himself, he confronts Toby and exclaims that while the movie was funny, he cannot accept the platitudes of the ending, pointing out that it does not address Toby's situation at all: "But those people on the screen ain't even supposed to be you! They're college students whose parents live in big houses in the suburbs. They're gonna get degrees, get good jobs and stop bein' nerds …. They're not twenty-six year old file clerks who live with their grandparents in a small apartment in an ethnic ghetto. They didn't get their computers like you did, by trading in a bunch of box tops an' $49.50 at the supermarket." With the attention to Toby's economic and educational status, in conjunction with his residence in an ethnic ghetto, Pekar here astutely calls attention to the function of class and race in the historical construction of the nerd. He makes it clear that the subjugated position of the nerds on screen is largely ephemeral: they will get good jobs and find acceptance among the very people who currently marginalize them. Pekar's miscalculation, however, was in underestimating the flexibility of nerd as a category of identity – rather than having to "stop bein' nerds," the real world analogues of the Tri-Lambs could continue to take on the mantle of subjugation that came with being a nerd long after they were financially successful, politically powerful, and culturally respected.

**Triumph of the Nerd?**

As the 1980s wore on, the notion of the socially-isolated nerd who succeeds despite his tormentors became so firmly enmeshed with computer enthusiasts that nerd was essentially synonymous with being technologically savvy by the close of the decade.

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It was being retroactively applied to the software entrepreneurs who were now moguls of monumental corporate empires. They were re-fashioned as nerds who turned to computing out of the need for acceptance, and the fact that some of them were now the richest men in America was evidence that their personal genius had succeeded in the face of all adversity. Under headlines invoking countless permutations of the 1984 film title – "The Nerds' Revenge," "The Return of the Nerds," etc. – major newspapers regularly pointed to the software moguls as evidence that the "nerds had won." Time magazine featured Bill Gates on the cover with the headline "Master of the Universe," only to compare him to a socially awkward teenager in the opening sentence.\(^\text{219}\) This narrative, of course, was imposed after the fact: in the early days of their successes, there are few or no journalistic accounts of these entrepreneurs embattled by either the forces of big business or of social barriers to their success. Rather, it is only after they have "won" that these obstacles are inserted into the history, turning it into a triumphalist underdog account. Much like their filmic counterparts, the bullies these real-life nerds reportedly faced only became a part of their stories once they had already overcome them.

Even some of their most biting critics offered a repackaged version of the same essential mythology. Robert Cringely, a technology gossip columnist, reveled in exposing the seedier and more salacious elements at play in Silicon Valley. His 1992 tell-all history of the software industry, Accidental Empires, is subtitled "How the Boys of Silicon Valley Make Their Millions, Battle Foreign Competition, and Still Can't Get a Date." Using Gates as a model, he frames his account by suggesting that none of the titans of industry ever really planned to be successful in business, and were motivated instead by their constant anxiety over how "uncool" they were:

A zillion dollars isn't enough, 7,000 employees who idolize him aren't enough – in fact, nothing is enough to prove to Bill Gates and to all the folks like him in the personal computer business that they are finally safe from the bigger, stronger, stupider kids who used to push them around on the playground …. There was no urge to fly, to see the world, to win a war, to cure disease, or even to get rich that explains how the personal computer business came to be or even how it runs today. Instead, the game was started to satisfy the needs of disenfranchised nerds like Bill Gates who didn't meet the macho standards of American maleness and so looked for a way to create their own adolescent alternative to the adult world and, through that creation, gain the admiration of their peers.\footnote{Robert X. Cringely. \textit{Accidental Empires: How the Boys of Silicon Valley Make Their Millions, Battle Foreign Competition, and Still Can't Get a Date}. New York: Basic Books, 1992. Print. 8.}

Of course, Cringely's account was belied by the basic historical facts. While one might speculate that anyone seeking power was driven by feelings of inadequacy, these empires were hardly accidental. Certainly, Microsoft and Apple's origins featured their fair share of happenstance, but Gates dropped out of university with the explicit intent of running a business, while Jobs was locating investors before the Apple computer ever went into production. Similarly, the emphasis on failures to meet the "standards… of maleness" and the subtitle's suggestion that they "can't get a date" are curious assertions for a text that seemed to delight in the salacious details of the romantic lives of its subjects.

Cringely may not have balked at the notion that the facts did line up so neatly, as he considered himself a "storyteller" rather than a historian. But we might ask, then, what the purpose of this story was. That much seems clear: it reiterated the myth promoted by the entrepreneurs themselves, that they were cultural outsiders who came from a world
where "what you did" mattered more than "who you were." And indeed, there were significant reasons to view the technoentrepreneurial moguls as outsiders in both the business and technology worlds. Their immediate backgrounds, for example, were often more tightly linked to amateur communities than to academia or corporate research. Several of the most celebrated among them were in fact college dropouts, and few were from wealthy families.

And yet, it is never clear by whom, precisely, these disenfranchised nerds were disenfranchised. Their social positions and connections to the "stagnant bureaucracies" they were so often framed against were central to their success. Both Jobs and Gates dropped out of college, but they dropped out of elite colleges: Reed and Harvard, respectively. Gates and Allen programmed the BASIC interpreter for the Altair – the software that launched Microsoft – by illicitly accessing Harvard's PDP-10 mainframe. Wozniak may have sold his calculator and Jobs his car for the initial funds to manufacture the Apple I, but within the year they had received a cash infusion of $250,000 from Mike Markkula, a multi-millionaire who had reaped a windfall from stock options while working at Intel. Virtually all of the software entrepreneurs worked and/or interned at large technology firms such as IBM before starting their own businesses. The software start-ups, then, were hardly outsiders, much less adversarial ones, to the bureaucratic worlds of large corporations and universities. With strong links – both personally and professionally – to university research complexes and technology corporations, it would be as accurate to characterize these men as the product of Cold War-era bureaucracy as the computing platforms on which they worked.
As personal computing and networking became a dominant force in the US economy, however, these connections were minimized in popular accounts of the industry. Combining vestiges of the countercultural images of hackers with the victimization of the nerd, these entrepreneurs became symbols of individuals who succeeded precisely by pushing against the institutional barriers which held them back. Fusing the language of revolution and personal success that would come to dominate technology journalism, popular histories like *Fire in the Valley* proclaimed the birth of the personal computer as "a time when cranks and dreamers saw the power they dreamed of drop into their hands and used it to change the world. It was a turning point when multinational corporations lost their way and kitchen-table entrepreneurs seized the banner and pioneered the future for everyone …. Hobbyists became visionaries, and visionaries became multimillionaires. It was a bona fide revolution." Television documentaries like *Pirates of Silicon Valley* (1999) and *The Triumph of the Nerds* (1996), based on *Fire in the Valley* and Cringely's *Accidental Empires*, respectively, highlighted the rebellious nature and countercultural links of the young entrepreneurs, who were banned from using corporate computers and disciplined by school authorities for putting the machines to unexpected uses. Particularly following the widespread adoption of home internet access and the Dot Com boom of the late 1990s, the term "computer revolution" was largely synonymous with the stories of these software moguls. Of course, "revolution" in this context was understood not as an effort towards social or economic justice, but as the freedom for entrepreneurial innovation in the face of bureaucratic stagnation. Story after celebratory story suggested that the success of these entrepreneurs

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was contingent not on their social position or family background, but on the individual merits of their ideas and foresight.

Quite to the contrary, however, the success of these young, middle-class white men took place within an industry that was profoundly shaped by the boundaries of nationality, race, class and gender, of which they were the ultimate beneficiaries. The microchips at the heart of the personal computer sensation, for example, were assembled by low-paid wage laborers, initially in the United States and Japan, and then, with the restructuring of the global economy throughout the 1980s, in export zones in East and Southeast Asia. By the conclusion of the decade, only limited assembly facilities remained in Silicon Valley for prototyping purposes. Karen Hossfeld, however, notes the marked similarity between the bodies staffing these assembly lines across the globe, including those in the United States: with white male managers overseeing brown bodies on the assembly floor. Hossfeld's study, which focuses on prototype assembly in Silicon Valley in the early 1980s, found managers, ninety percent of whom were white males, explicitly structuring their labor force in accordance with racial and gendered logics. They divided the workforce according to nation of origin, both to establish clear hierarchies of pay based on ethnicity, as well as to inhibit labor organization. The lowest-paid, lowest-skilled jobs fell to immigrant women regardless of background or experience, as managers appealed to the notion that their income should be supplementary to a male breadwinner's. The secondary status for women was often quite explicit: for example, one firm outlined in Hossfeld's study assigned different colored smocks to men based on their profession or assigned tasks, while all women, regardless of assignment, wore pink smocks. Hossfeld neatly captures the radical gap between the
image of the information technology industry – so intimately tied up with the software
moguls – and its realities when she writes "for every young, white boy-wonder who made
his first million tinkering in the garage … there are scores of low-paid immigrant women

Likewise, within the world of software development, US immigration policy
established clear national hierarchies for software engineers, particularly after the
introduction of the H1-B visa program in 1990. The H1-B visa program was originally
presented to the US public as a way to meet the growing demand for information
technology professionals, and was heavily lobbied for by software companies like
Microsoft and Apple. H1-B visas (hereafter referred to as H1-Bs) were only awarded to
particular classes of skilled and educated workers. Further, H1-Bs were only issued in
conjunction with an employer who could demonstrate a need which could not be met by a
current resident of the US. H1-B recipients were allowed to work up to three years in the
US, and they could petition to have an extension for another three years. During the
1990s, workers on H1-B visas made up approximately one-sixth of the employees in US
information technology industries, according to Payal Bannerjee. The vast majority of
H1-Bs were granted to Indian and Chinese professionals, with Indian professionals alone
accounting for about half of all H1-B recipients. Further, within the information
technology sector, Indian and Chinese H1-B workers counted for an even greater
majority – representing over seventy-five percent of immigrant information technology
professionals. It was not without reason, then, that H1-B workers were referred to as the "workhorse of the IT industry."\(^{223}\)

However, the fact that the information technology industry was dependent on the labor of these individuals does not necessarily mean they are treated well. One of the most pernicious aspects of the H1-B was the fact that it was tied to a specific employer. Consequently, losing one's job translated directly into losing one's immigration status. As Paula Chakravartty has documented, this often made workers operating under an H1-B status afraid to object to unfair pay differentials or poor working conditions. Demanding a raise or time to see one's family could lead not only to a loss of income, but to deportation.\(^{224}\) Chakravartty's informants further reported that employers often expect H1-B employees to work up to twenty percent overtime and earn up to $20,000 per year less compared to their native-born counterparts. They received promotions and pay raises at a significantly lower rate than American-born workers. Further, though somewhat reluctant to talk about it, several of her informants noted instances of racial discrimination and insults both on and off the job.\(^{225}\) As Chakravartty writes, "Their class identification as skilled workers has to be weighed in relation to their configuration as racialized subjects whose 'indentured servitude' is marked simultaneously by a colonial division of labor and the legacy of Orientalist discourse."\(^{226}\)

\(^{225}\) Chakravartty 38-40.
\(^{226}\) Chakravartty 29-30.


**Conclusion**

Popular discourse surrounding the software industry, however, rarely interrogated the functions of gender, race, and nation in the conditions of production. Rather, these questions are largely effaced by the cult of personality that surrounds the leading entrepreneurs. In particular, their representation as nerds establishes them as victims who overcame the social obstacles in their way, rendering largely invisible the immense social benefits they gained as white, well-educated men from relatively affluent families. Rather than cogs within immense systems – social hierarchies of race and nation, legal formulations of immigration and citizenship, technological development through collaborative efforts between the military, public research agencies, and corporate partners – they are recast as intrepid individuals who succeeded despite these systems, rather than because of them. Thus, in cloaking themselves in the victimization of the nerd, these entrepreneurs became the perfect mythical figures for the banner of neoliberal economics.

Of course, with the success of Reaganism and the rise of the New Right, the celebration of entrepreneurialism and antagonistic views of the state was hardly restricted to software development in the 1980s. The shift in representing computer scientists here, from military contractors and stodgy IBM company men to quirky, loveable nerds, is part of a much broader shift in the US political economy in the closing decades of the twentieth century. As a number of scholars, including among others Lisa McGirr and Monica Prasad, have noted, the 1980s represented a significant break from the postwar consensus that dominated the previous three decades. The emergence of neoliberal economic policy meant a significant reduction in the perceived role the state should
ideally be playing in the market. In practical terms, this meant an embrace, albeit
sometimes unevenly, of policies that favored deregulation, lower taxation, and cuts to
most areas of government spending outside of defense. At an ideological level, it meant a
discursive embrace of "small business," "entrepreneurs," and "innovators" as emblems of
individualistic success to justify these new economic policies.227

But while the celebration of individualism and entrepreneurialism was part of a
much larger movement in US culture, it took on added dimension when applied to the
realm of computer science. Specifically, Congressional outlays for scientific research
were among the few programs of the Cold War consensus state that remained politically
popular with both the right and the left throughout this period. Successful, highly visible
projects like the Internet were essential for fostering this bipartisan popularity and for
negotiating the contested sets of meanings surrounding federal investments in science and
research. For the left, government-funded science signified the tremendous potential of
public investments, while for the right the allocation of those funds through grants and
contracts to private universities and research firms hailed the utility of competition and
private enterprise. For both sides, the significant achievements of US science in the
twentieth century helped bolster the image of American exceptionalism, as the successful
fusion of capitalism and democracy to serve as a model "City on the Hill" for others to
emulate.

But as discussed in previous chapters, science funding in the immediate postwar
era was always positioned as a question of the public good, that is, either in the interests

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of national defense or the elevation of general standards of living. The transmutation here of the computer scientist into a distinctly private individual – the entrepreneur – radically shifted the meaning and relevance of scientific research. Rather than a common good, the vision articulated in the countless permutations of the "Triumph of the Nerds" narrative is one in which technological mastery enables individual success. The promise of this narrative is that this individual success is available to anyone who has the right idea at the right time. Through the rags-to-riches stories of nerds who overcame their social circumstances, we are told these immediately personal technologies empower us, as individuals, to realize our dreams and visions. As Barbrook and Cameron note, "In this version of the Californian Ideology, each member of the virtual class is promised the opportunity to become a successful hi-tech entrepreneur. Information technologies, so the argument goes, empower the individual, enhance personal freedom, and radically reduce the power of the nation state." Of course, this argument is belied by the institutional structures that gave rise to both the software entrepreneurs themselves and the technologies of digitally networked computers that ultimately made them famous.

Nevertheless, the ideological connection between nerds, entrepreneurial success, and neoliberal economics remained quite potent. As recently as 2007, Bryan Caplan, a respected economist at George Mason University, proposed what he calls the "Jock/Nerd Theory of History." Caplan, a proponent of free market economics and a minimalist state, painted a picture of economic history as one in which, for most of history, brainy nerds feared their brawny jock neighbors and were consequently coerced into forking over a share of their wealth, writing "Through the lens of the Jock/Nerd Theory of History, the welfare state does not look like a serious effort to 'equalize outcomes.' It

\[^{228}\text{Barbrook and Cameron.}\]
looks more like a serious effort to block the 'revenge of the nerds' - to keep them from using their financial success to unseat the jocks on every dimension of social status." It is noteworthy that Caplan, who had described himself as "an openly nerdy man," identified nerds here not primarily on their technical prowess but on the twin traits of victimhood and economic success.

Caplan's facile proposition equating nerds with victims of the welfare state could, of course, only be made in light of the previous thirty years of cultural work to cement precisely this victimized image of a nerd. Removed in his formulation, for example, were all the public investments in science education, research, and infrastructure that made possible this "revenge of the nerds" in the first place. Moreover, it seems evident that he hardly had in mind famously left-leaning bookish individuals like Adlai Stevenson or, for that matter, Leon Trotsky, when he suggested nerds' braininess would lead them inevitably to financial success. Rather, a nerd was defined precisely by his victimization and suffering at the hands of extant social structures: a "revolutionary" with a distinctly private agenda of personal gain. A far cry removed from images of the public scientist in the mid-twentieth century, the new face of technological innovation was one in which any public good could only be understood through a rubric of private profit.

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Chapter 5: Forensic Families

Following the radical success of *CSI: Crime Scene Investigators* [*CSI*], several televised police procedurals shifted their focus away from detectives or court officers to the functions of forensic scientists and laboratories. A wide swath of television crime dramas began to feature scientists in a diverse array of disciplines, from medical investigators to mathematicians, as lead characters. Still other series, such as *House* (2004), maintained the plot structure of the police drama while dispensing with the need for either police or criminals in favor of doctors and diseases. The fusion of the police procedural, long a mainstay of American television, with the rhetoric and aesthetics of scientific investigation thus birthed a new subgenre, the "scientific procedural," within the decade.

The meteoric rise of these scientific procedurals quickly led to much speculation about both the causes of audience fascination as well as concern over the ideological impact of these genre shows. Some critics, such as Byers and Johnson, have argued that this new strand of television scientific crime dramas functioned as a cultural suture in the wake of several perceived failures of the state's law enforcement and security responsibilities. Most dramatic among these failures, of course, were the inability of the FBI and military intelligence communities to prevent the attacks on September 11th, 2001, or to locate and apprehend the orchestrators during the immediate aftermath. Beyond this, however, the high-profile use of DNA evidence to exonerate hundreds of convicted criminals – even those on death row – cast severe doubt upon the ability of the state to identify and punish criminals. Scientific procedurals extend the format of the

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police drama, in which perpetrators are identified, apprehended, and punished with certainty every week, to marry them to the rational, positivist framework of the scientific method. Under this line of reasoning, these procedurals thus work to close the ideological rupture and hold skepticism at bay, by reassuring the audience that the criminal justice system operates with the same degree of precision and certainty.

There is certainly much to be said for the cultural reassurance at work in scientific procedurals. However, the above line of argument presumes a context in which the certainty of science, and the unbiased position of scientists, is unchallenged. This, however, was hardly the case by the time of CSI's debut: even the rough Cold War cultural consensus in support of science as an arbiter of truth had substantially eroded. The ascendancy of postmodern thought in the nation's universities in the latter half of the twentieth century, coupled with the rise of science studies and the sociology of science, led to the increasingly popular notion that all knowledge, including scientific knowledge, was motivated and contingent. During the same period in which scientific procedural shows were rapidly growing in audience share, virulent attacks on scientific neutrality were playing out in the national headlines over a host of issues. Participants from both ends of the ideological spectrum might mobilize scientific discourse in one debate only to just as quickly dismiss science as tainted by partisan funding processes or biased investigators in another. For example, elements of the political left consistently denounced scientific advances in genetically modified food production, while the political right's hostility towards climate science in the twenty-first century was visible at every turn. However, in the wake of September 11th and the genesis of the War on Terror, these relativistic approaches to knowledge became increasingly politically problematic.
As Judith Butler notes, "we have heard from Vice-President Richard Cheney and Edward Rothstein of the *New York Times*, among several others, that the time to reassert not only American values but fundamental and absolute values has arrived. Intellectual positions that are considered 'relativistic' or 'post-' of any kind are considered either complicitous with terrorism or as constituting a 'weak link' in the fight against it."\(^{231}\)

Contemporaneously with the reactionary political movement against postmodernism's emphasis on contingent epistemologies, the security functions of the state took on a radically increased significance in daily life. In *State of Exception*, Georgio Agamben argues that beginning in the mid-twentieth century, "the voluntary creation of a permanent state of emergency ... has become one of the essential practices of contemporary states, including so-called democratic ones." He further suggests that the passage of the USA PATRIOT Act and the declaration of a permanent War on Terror in the wake of the September 11\(^{th}\) attacks are evidence that the exercise of this security state is the "original structure in which law encompasses living beings by means of its own suspension."\(^{232}\) In other words, the invocation of a continual state of crisis is used, paradoxically, to extend the reach of the state's juridicolegal apparatuses precisely by ending the "rule of law," in the sense of codified and recognized rights and procedures. In Agamben's formulation, these security functions, and their attendant suspensions of civil society, thus become not only an important feature of the contemporary state, but indeed its defining one.

This chapter argues that, in their peculiar fusion of law enforcement activities and scientific explication, these scientific procedurals suggest that the codices that make up

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the rule of law can be supplanted by technoscientific certainty through their reassertion of a mutual framework of "the rational" in both scientific process and the state's juridical structures. In the worlds of CSI and its descendants, there are no mysteries that cannot be conclusively and objectively solved, and if we lack perfect knowledge it is only because we haven't yet applied the proper state resources or scientific know-how to the issue. Gil Grissom (William Peterson), the lead investigator of CSI, insists on this every time he invokes his catch phrase, "The evidence never lies." The insistence on visual hyper-verisimilitude and the tautologically conclusive plots construct an epistemic framework within which this is "the way the world really is." Scientific procedurals thus recuperate the ideology that both institutions – science and the state – are ultimately rooted in rational objectivity, to buttress the positivist strains of modernist epistemology against the postmodern contention that knowledge is diffuse, contingent, and self-interested. In a word, Agamben's "state of exception" is justified, here, because within the dramatic structure of the scientific procedural, the relationship between scientists and the state assures us that the application of state violence is never misguided, even in the absence of juridicolegal rights.

An examination of CSI, Numb3rs (2005), and Bones (2005) demonstrates that this relationship is often shown as domestic and/or romantic in nature: in a word, as familial. While this does have the effect of bolstering the public image of both the state's role in law enforcement and the neutrality of forensic scientists, it also contributes to the larger set of discourses surrounding the proper role of civil governance of the sciences. Rendering the connection between the law enforcement and scientific functions of the state as a specifically familial relationship demands and constructs an intimacy – if not
always an equality – between the two forces. While they sometimes appear to be at odds with one another, the familial structure of their bond mediates and defuses this tension, refocusing both the scientist and the detective on the security of the family unit. The criminal justice system and scientific institutions, in this configuration, become mutually constitutive of the public good through their embodiment as parallel arms of the state. It is likely for this reason that the criminal perpetrators in scientific procedurals are so frequently scientists or law enforcement agents themselves: law enforcement agents who operate without the empiricism of science become misguided vigilantes, while scientists operating outside of the state lose sight of the social formations that make their work relevant.

By rendering this relationship as interpersonal, scientific procedurals also perform another kind of cultural work: they transform the pursuit of justice into a decidedly personal quest. As the relationship between science and the state is represented as familial, criminality is configured as a transgression against that domestic unit. Through a discursive mobilization of victims and victimhood, the state response to this transgression is similarly personalized, as retributive violence against particular criminal bodies becomes the primary aim of the criminal justice system. This individualization of "justice" precludes other questions about broader formations of the term: for example, the ways in which civil procedures, rights to privacy, restraints on state power, or especially the merits of mercy or forgiveness, might serve the interests of a more generalized justice are supplanted here by the demands of personalized vengeance. In this light, it is important to note that when I suggest above that the shared rationalist ideology of the two institutions is offered as the guarantor of the public good, the public good is understood
implicitly within the realm of the scientific procedural as concomitant with private restitution. Thus, the primary function of the security state and, by extension, the state apparatus as a whole, is not collective well-being, per se, but rather the mitigation of transgressions against private individuals.

Indeed, even the most basic collective good one might expect of a security state – communal safety – is nowhere to be found in the scientific procedural. For all the power of rational investigation to sort out and piece together even the most puzzling or esoteric evidence after a crime has been committed, any question of crime prevention remains well beyond the scope of what their protagonists can offer. Quite to the contrary, the dramatic logic of these serials depends precisely on the ever-present threats of a chaotic world. In the world of the scientific procedural, violence is not only pervasive, but random and unpredictable. Each of us may be killed, in the most horrific of imaginable fashions, at any moment by a friend, loved one, or complete stranger. The security state, here, is a necessary response to a permanent state of insecurity.

As the primary portions of this chapter center on an analysis of three popular television serials it is important to note some of the challenges and limitations in discussing television at the dawn of the twenty-first century. In particular, although I conduct close readings and discursive analyses of some of these series’ content, this should not be taken as evidence that these procedural shows can be entirely read as discrete, coherent artifacts. As described by Raymond Williams, one of the primary aesthetic drives of American television is that of flow, or the way that short, discernible sequences of sounds and images lead seamlessly from one to another. Williams contends that while there may be an impulse to read a television series or even an individual
episode as a single text, this fails to account for the way that such a hypothetical text is both framed by the programs that precede and succeed it on the air or the way that advertisements interrupt the program. Rather, Williams suggests that we must consider the primary aesthetic drive of television as being to simply keep the television on in the viewers' household, which it does by flowing smoothly from one short sequence – a five-minute arc in a sitcom, a two-minute story on the nightly news, or a thirty-second advertising spot – to the next, rather than to present an internally coherent thirty- or sixty-minute program.

There are certainly reasons to challenge the application of Williams' conception of flow when grappling both with these particular series and with the larger discursive formations of contemporary television. For example, all three of the shows discussed in depth in this chapter embrace the serial format to varying degrees, offering both season- and series-long narrative arcs which are intended to be viewed sequentially. While each episode of a scientific procedural, for instance, may offer a self-contained story about a single crime, the romantic and familial tensions that surround the primary characters are often less meaningful outside the larger narrative backdrop of the series. More broadly speaking, broadcasting, the delivery technology Williams' was describing, has decreasing relevance to the production and distribution of television with the rise of personalization technologies and new delivery media ranging from the VCR and TiVo to digital downloads and streaming video, all of which place greater demands on internal narrative coherence for a given episode or series sold as a single unit.

However, while these transitions are significant to any theoretical application of flow to these procedurals, this is not to suggest that we can dispense with Williams
altogether. Although these shows may place greater emphasis on internal coherence and sequential narrative, they are presented within and draw upon a larger cultural backdrop in which images, sounds, and signs are drawn upon freely and deployed referentially across a wide range of media. Scientific procedurals may draw their most direct inspiration from crime dramas, but the significance of their aesthetic and narrative elements are incomprehensible outside of the flow of images and sounds that surround them in American televisual culture. These shows draw inspiration from a wide range of contemporary popular sources, including characterization from teen dramas and plot lines ripped straight from the nightly news. Simultaneously, their aesthetic efforts at using CGI for hyperrealistic effects have been mimicked by documentary filmmakers, cable news networks, and situation comedies. Thus, while a given evening's offering on a particular broadcast channel may be less interstitial than it was a few decades ago, the more generalized mimetic flow within and across televisual media looms larger than ever. For this reason, Williams' critical inquiry into flow remains essential to understanding both scientific procedurals and twenty-first century television more broadly – while the particulars of delivery and reception have undoubtedly shifted, intertextuality remains the modus operandi of American television.

For these reasons, it is crucial to understand my analyses of the scientific procedural as taking place within the larger discursive fields in which they are both produced and received. The centrality of (in)security and anxiety, for example, is not unique to scientific procedurals, but is rather symptomatic of the flow of post-9/11 culture across a wide range of genres and discourses.233 Indeed, part of what may make these shows more palatable to a larger political cross-section of the viewing public is

their contrast with contemporary shows like 24 (2001) and The Shield (2002): compared to the indiscriminate brutality and torture exhibited elsewhere on post-9/11 television, the methods of a forensic scientist in a scientific procedural appear relatively benign, even if they each justify state violence as necessary under the banner of security. Likewise, when procedurals employ shaky, hand-held cameras during chase scenes to generate both intensity and a perception of authenticity, they are able to do so precisely because this technique has long been the dominant visual motif of documentary-style "reality" shows such as Fox' COPS (1989). Thus, as with the emergence or transformation of any generic conventions, the scientific procedural exists in constant conversation with the rest of the commercial genre system.

However, taken in their totality, these tropes and aesthetic techniques, when employed within scientific procedurals, take on the additional discursive effect of speaking to and illuminating shaping popular understanding of the relationship between forensic scientists and the state. Thus, even though for the sake of organization I discuss each series individually and, at times, highlight the distinctions between them, I do not mean to suggest that they should be read independently or even that a particular series is at all times internally self-consistent. Over the lifespan of a given television show, hundreds of individual writers, directors, producers, cast, and crew will exercise various levels of creative input. Not only does this mean that individual episodes, sequences, or story arcs may be ideologically inconsistent with others, but also that those creative individuals are themselves influenced by the shifting cultural and institutional priorities in which they operate. Rather, I am interested in, to borrow a turn of phrase from McLuhan, the "total field" of scientific procedurals and the shape they lend to discourse
surrounding both science and state governance. To put it simply, the significance of each of these serials as discrete texts is minimal compared to the constant barrage of televisual images of scientists solving crimes, night after night and week after week. It is this totality – and its presentation of rational objectivity, familial relations, and individual vengeance – that forms the present object of study.

**Innocence Project and the NAS**

Since shortly after *CSI*'s debut in 2001, criminal attorneys, cultural critics, and the popular press have argued about the net impact of the "CSI Effect," or what influence its very wide viewership would have on actual jury trials where forensic science was in play. Based on anecdotal evidence, some suggested that the glamour and moral certainty of the show would harm defendants as juries overestimated the reliability of forensic science. On the other hand, prosecutors feared that juries would begin holding forensic witnesses to the standards that their profession was being portrayed on television – a standard which they could never measure up to, in either aesthetic presentation or objective certainty. Regardless, however, what both lines of reasoning betray is the implicit assumption that popular television will in fact impact the public's faith in forensic science.

There has been some quantitative research on the subject since that time which indicated a possible slight bias among *CSI* viewers against weak forensic evidence. As Schweitzer and Saks note, "*CSI* leads viewers to expect high-tech science and something more than the intuition of the witness, so that when in court they are presented with much

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lower-tech science and the witness' subjective judgment, they are likely to find it less convincing than do non-CSI-viewers. However, while it is true in the narrow context of an individual court case that the CSI effect may work against the testimony of forensic experts, the very fact that CSI viewers expect more compelling evidence suggests that they believe "high-tech science" does indeed offer the possibility of greater prosecutorial certainty.

If CSI did increase the public's belief in the certainty of forensic evidence, it came at something of an ironic moment in the history of the American criminal justice system. Nine years prior to CSI's premiere, two New York attorneys, Barry Scheck and Peter Neufeld, in conjunction with the Benjamin N. Cardozo School of Law, founded the Innocence Project, a non-profit organization devoted to post-conviction relief for wrongfully convicted individuals. The agency provides legal counsel and assistance to people convicted of crimes where there is factual evidence of their innocence. Some of the most frequently used evidence of innocence – and certainly the most high profile – involves DNA testing, although the Project's affiliates in the Innocence Network are willing to consider any case where there is substantive evidence of innocence.

In the two decades following its founding, the Innocence Project helped to exonerate over three hundred wrongly convicted individuals, including some very high profile cases in the late 1990s. The exonerated were overwhelmingly men of color, and on average they served over thirteen years in prison before having their verdicts overturned. They were largely ineligible for parole, because they were not willing to accept responsibility for crimes they did not commit. Seventeen of the exonerees were

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initially sentenced to death and served time on death row.\textsuperscript{236} For example, one noted case involved the wrongful conviction of Calvin Johnson on charges of two rapes. Johnson was convicted and sentenced to life imprisonment based largely on testimony from eyewitnesses who had previously identified other men and repeatedly changed their accounts of the events. The conviction was overturned in 1999 based on DNA evidence, after he had served sixteen years in prison. Johnson then went on to serve on the Innocence Project board of directors.\textsuperscript{237}

While the project's founding was spurred in part by a Justice Department report about the unreliable nature of eyewitness testimony, it quickly became apparent that forensic science was also responsible for a great number of wrongful convictions. By the project's own estimate, in the first 250 exonerations based on DNA evidence, fifty-two percent of the convictions were secured at least partially on the basis of faulty or unreliable forensic evidence.\textsuperscript{238} Many of the techniques used in forensic science, such as matching hair types or matching objects with impressions left in wounds or on bodies, had never undergone extensive scientific analysis as they were developed on a case-by-case basis. Others were scientifically valid, but juries were frequently misinformed about how significant their findings were. For example, another high profile Innocence Project case involved Alejandro Dominguez, who was convicted of rape based on a blood type match with semen found at the scene. Although blood type analysis is based in sound

\textsuperscript{238} Scheck and Neufeld.
scientific technique, the jury was not informed that over half the men in the United States would have matched the sample using blood type alone.\textsuperscript{239}

In the wake of these highly publicized reversals, in late 2005 Congress directed the National Academy of Sciences [NAS] to review the present state of the forensic sciences and their appropriate use in the courtroom as part of the Science, State, Justice, Commerce, and Related Agencies Appropriations Act of 2006.\textsuperscript{240} The charge was extensive, as it required the NAS to both examine the merits of a diverse body of sciences and to reconcile scientific criteria with legal standards for admission of evidence. Notably, however, in its eight point charge to the NAS, the Congressional directives did not directly mention the failures of forensic science over the previous decades. Rather, they only indirectly alluded to some of the difficulties by requesting that the NAS assist in developing best practices for the forensic sciences, suggesting that these did not yet exist. Moreover, much of the emphasis in the original legislation was on developing additional sources of funding or training programs, suggesting that the problem was not that the forensic sciences are inaccurate or untested, but rather that there was simply a demand for more scientists.\textsuperscript{241}

\textsuperscript{239} "Unreliable or Improper Forensic Science." New York: Benjamin N. Cardozo School of Law, Yeshiva University. Web. 26 Nov. 2012.
\textsuperscript{240} Although passed in 2005, the bill set the funding for 2006 fiscal year, hence the name.
\textsuperscript{241} Committee on Identifying the Needs of the Forensic Sciences Community, National Research Council. Strengthening Forensic Science in the United States: A Path Forward. Washington, DC: The National Academies Press, 2009. Print. The full list of directives is as follows: (1) assess the present and future resource needs of the forensic science community, to include State and local crime labs, medical examiners, and coroners; (2) make recommendations for maximizing the use of forensic technologies and techniques to solve crimes, investigate deaths, and protect the public; (3) identify potential scientific advances that may assist law enforcement in using forensic technologies and techniques to protect the public; (4) make recommendations for programs that will increase the number of qualified forensic scientists and medical examiners available to work in public crime laboratories; (5) disseminate best practices and guidelines concerning the collection and analysis of forensic evidence to help ensure quality and consistency in the use of forensic technologies and techniques to solve crimes, investigate deaths, and protect the public; (6) examine the role of the forensic community in the homeland security mission; (7)
Nevertheless, under the broad mandate to "examine additional issues pertaining to forensic science as determined by the Committee," the NAS spent much of its investigation concerned with the uneven standards and lack of scientific verification within the various disciplines of forensic science. In early 2009, the NAS published its findings as *Strengthening Forensic Science in the United States: A Path Forward*. Out of deference to their colleagues who were practitioners of forensic science, the committee went to great lengths to praise the work of forensic sciences over the course of the twentieth century in identifying and apprehending criminals. However, the NAS' basic finding was fairly damning of the state of the forensic sciences:

The forensic science system, encompassing both research and practice, has

*serious problems* that can only be addressed by a national commitment to overhaul the current structure that supports the forensic science community in this country. This can only be done with effective leadership at the highest levels of both federal and state governments, pursuant to national standards, and with a significant infusion of federal funds.  

The problems identified by the Committee were extensive. First and foremost, the committee concluded that many of the branches of forensic science did not adhere to the scientific method or the standards of peer review of publications. The report further noted that, apart from nuclear DNA analysis, virtually all of the forensic disciplines which focused on individualization, or conclusively matching evidence to an individual suspect, lacked scientific rigor. The authors argued that "some forensic science disciplines are supported by little rigorous systematic research to validate the discipline's basic premises

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[examine] interoperability of Automated Fingerprint Information Systems [AFIS]; and (8) examine additional issues pertaining to forensic science as determined by the Committee.

242 Committee on Identifying the Needs of the Forensic Sciences Community xx. Emphasis added.
and techniques. There is no evident reason why such research cannot be conducted.\textsuperscript{243}

Further, they raised concerns about the lack of standards both within and across disciplines, finding that "Standards and codes of ethics exist in some fields, and there are some functioning certification and accreditation programs, but none are mandatory. In short, oversight and enforcement of operating standards, certification, accreditation, and ethics are lacking in most local and state jurisdictions."\textsuperscript{244}

The committee also criticized federal evidentiary standards with regards to forensic evidence. The primary precedent for admitting forensic evidence at trial came from \textit{Daubert v. Merrell Dow Pharmaceuticals, Inc.} in 1993, under which the United States Supreme Court held that trial judges were ultimately responsible for ensuring "any and all scientific testimony or evidence admitted is not only relevant, but reliable." The decision gave broad discretion to trial judges to determine what constitutes "reliable" evidence, with review available only in the narrow circumstance that such discretion is abused.\textsuperscript{245} The NAS, however, suggested that \textit{Daubert} had been poorly implemented, noting that "Federal appellate courts have not with any consistency or clarity imposed standards ensuring the application of scientifically valid reasoning and reliable methodology in criminal cases involving \textit{Daubert} questions." The committee further argued that based on the data available from reported decisions, the application of \textit{Daubert} in criminal cases seemed to clearly favor expert witnesses for the prosecution,

\textsuperscript{243} Committee on Identifying the Needs of the Forensic Sciences Community 22.
\textsuperscript{244} Committee on Identifying the Needs of the Forensic Sciences Community 23.
who were excluded much more infrequently than witnesses for the defense. The report even went as far as to cite Innocence Project founder Peter Neufeld's article on the "irrelevance" of Daubert.

The NAS report conceded, as the Justices in Daubert noted, that science and the law operate under different epistemic regimes of truth. The adversarial system of the courtroom is ill-suited to advancing scientific knowledge and, conversely, the "perpetual revision" of the sciences works against the social need for finality in legal decisions. However, as convictions are reached based on the testimony of expert forensic witnesses who invoke the rhetoric of scientific knowledge in their testimony, the committee argued that "Law enforcement officials and the members of society they serve need to be assured that forensic techniques are reliable." The committee pointed out that this serves the dual purpose of not only limiting the number of false convictions, but of properly identifying those who have committed criminal acts so that they may be brought to justice.

The committee's primary recommendation for reform was to establish a federal umbrella agency to govern the forensic sciences. The report considered both the National Science Foundation and the National Institute of Standards and Technology, but suggested that both lacked existing ties to the forensic science community, which would have hindered any transition and likely translated to inadequate leadership. The report also entertained the notion of housing the new agency within the Department of Justice, but here the authors were much more vigorous in their opposition, noting that "Forensic

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246 Committee on Identifying the Needs of the Forensic Sciences Community 11. The Committee is careful to note, however, that this is based only on data from reported decisions and may not accurately represent all evidentiary hearings, which are not always published or appealed.


248 Committee on Identifying the Needs of the Forensic Sciences Community 11. Emphasis in original.
science serves more than just law enforcement; and when it does serve law enforcement, it must be equally available to law enforcement officers, prosecutors, and defendants in the criminal justice system. The entity that is established to govern the forensic science community cannot be principally beholden to law enforcement. The potential for conflicts of interest between the needs of law enforcement and the broader needs of forensic science are too great.\textsuperscript{249} This directly echoed many of the existing critics of the forensic science community at local levels, who had pointed out that budgetary links to law enforcement agencies placed pressure on forensic laboratories to produce results that were corrosive to their scientific missions as finders of fact.

In short, \textit{Strengthening the Forensic Sciences}, a report commissioned by Congress, conducted by the NAS, and published by the National Research Council, read much as one would expect from a publication from an Innocence Network affiliate. It called into question the merits of even long-standing forensic techniques such as fingerprint analysis and contended that there was little distinction made in practice between highly reliable techniques of identification, such as DNA analysis, and those without even the most preliminary basic research. The committee identified significant problems with both technique and standardization across laboratories in most of the subdisciplines they examined. Ultimately, they concluded that reform was highly unlikely to come from either the judiciary or the forensic community itself, as political exigencies prevented either from making sweeping changes in evidentiary support without Congressional initiative. The only path forward that the NAS could identify was through legislative

\textsuperscript{249} Committee on Identifying the Needs of the Forensic Sciences Community 17.
reform, ideally at a federal level as state judiciaries were likely to follow the lead of the federal government.

The return of the report to Congress was met with stunning silence on Capitol Hill. Both the federal legislature and the Department of Justice appeared uninterested in taking up the question of forensic science reform. Significantly, in contrast to the debates surrounding the best way to meet Vannevar Bush's call for a federal research agency in the 1940s, this was not a question about the best method of implementation or governance structure for the forensic sciences, but rather a complete lack of discussion. The only major push to implement some of the Committee's recommendations at the state level came about in Arizona, where it was quickly and decisively resisted by the forensic science community, who objected to outside interference in their disciplines. As of this writing, no tangible efforts have been made at systemic reform of the forensic sciences or federal evidentiary standards. Even as legal reformers and the NAS were highlighting the significant failings of the forensic sciences, however, one would hardly glean this from watching serial crime dramas on popular television. Indeed, as shows like *CSI* grew in popularity, television offered a world of forensic science, both visually and narratively, capable of absolutely astounding feats and ever more certainty in its results.

**CSI and the Emergence of the Scientific Procedural**

*CSI* debuted to American audiences in October 2000 and rapidly grew in ratings share to become one of the highest rated scripted shows on television. It spawned two direct spin-offs which mimicked the format of the original as well as a host of imitators.

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on other networks. Both the original series and the second spin-off, *CSI:NY*, remain on the air as of this writing, with *CSI* presently in its 13th season. It was rated as the most watched show in the world for five of the seven years between 2005 and 2012.\(^\text{251}\) It was also received well critically, winning six Emmys over its run and being nominated for dozens of others.

The original series featured an ensemble cast of "Crime Scene Investigators" [CSIs] in Las Vegas. A typical episode begins with a cold open in which one or more citizens or law enforcement officers unexpectedly discover a dead body or the scene of a murder. The action then follows the investigators as they deduce the circumstances of the crime and the identity of the perpetrator through an examination of evidence found at the scene and interviews with witnesses. Over the course of an episode, the investigators visit the scene of the crime to collect evidence, return to the laboratory and/or the morgue to process the clues, interview witnesses, and pursue and apprehend suspects. These latter plot actions are particularly significant, as they mark the investigators as law enforcement officers in addition to being scientists. Many of the characters slip seamlessly between being lab technicians, applied scientists, and criminal detectives – roles which are generally kept intentionally separate in American law enforcement regimes to prevent contamination of evidence or undue bias in testing procedures. Within the world of *CSI*, however, little distinction is made between these professions. In other words, criminology is scientific inquiry and vice-versa within this ideological frame.

The criminal cases almost universally present extremely unusual circumstances at the outset, although these are often explained as the result of a seemingly logical

sequence of events later. For example, an early episode of CSI: Miami involves a body that presents the symptoms of snow blindness. The investigators immediately note the oddity of finding snow blindness in Miami, and almost simultaneously discover evidence of occult activity at the scene. When they discover that the victim is a charismatic professor who wielded tremendous influence over his students, the investigators begin to suspect that he was brainwashing or indoctrinating his students and that his death was the result of an occult ritual. At the conclusion of the episode, however, the culprit is revealed to simply be an angry student who flew into a rage in response to the professor's constant berating. The snow blindness comes from having his head smashed into a photocopier, and the occult signs are simply an effort to disguise the student's involvement. Thus, as each set of bizarre, seemingly incongruous facts is placed in coherent causative sequence, the investigators reimpose order and rationality on a complex and chaotic world.

One of the most commented upon features of CSI was the integration of CGI sequences to render the investigators' interpretation of the evidence visible. For example, as an investigator explains the significance of a particular clue or postulates a theory of the crime, time may speed up or slow down, the camera may zoom in to impossible detail— including inside of human bodies—contrast and lighting may shift to highlight some previously invisible object, or ghostly silhouettes may stroll across the crime scene. These imaginative displays are often matched by the technological tools of the investigators themselves, such as computer simulations re-enact a crime in remarkable detail or chemical sprays which highlight latent fingerprints in bright fluorescent colors.

As Byers and Johnson astutely note, "[T]he [CSI] series are hyper-oriented toward a display of forensic technologies that is clearly fetishistic. These technologies are

represented as necessary to solving crime (both particular crimes and "crime" as a whole) and mitigating risk." The technologies on display frequently make possible within the diegetic frame what the audience is treated to in the imaginative displays. The net effect of the combined filmic tools – the non-diegetic reconstructions of the crime and the fetishization of technology – works to suggest that both the forensic scientists' imagination and the tools they employ are able to accurately and objectively capture real events.

The pilot episode establishes several of the themes that permeate the rest of the series. The traditional locuses of legal authority, for example, are shown to be fraught with subjectivity and failure. An African American CSI is confronted and detained by police officers solely on the basis of race. A few moments later, a judge capriciously refuses to issue a search warrant, and just as capriciously reverses his decision in exchange for an inside betting tip on an upcoming football game. By way of contrast, lead investigator Gil Grissom admonishes one of his staff members on the importance of impartiality after he becomes too zealous: "There is no room for subjectivity in this department …. We handle each case objectively without presupposition, regardless of race, color, creed, or bubblegum flavor." The sermon, however, is delivered in an odd context, as the investigator in question has not actually been led astray by his subjectivity. Rather, it is offered for the benefit of the audience, to establish a clear difference between the CSIs and the regular police department. This episode also features the first (of many) variations on Grissom's catch phrase, as he tells another investigator to "Concentrate on what cannot lie: the evidence." When the evidence does mislead him later in the episode, as fingerprints at a crime scene lead Grissom to a man who sells fake latex hands for

\[253\] Byers and Johnson xv.
Halloween costumes, Grissom seems relatively untroubled in his world view. Later in the first season, it is revealed that the man who modeled for the hand is the killer after all, ultimately vindicating Grissom's belief in the infallibility of physical evidence.

The pilot also establishes the familial nature of the CSI team. Grissom, who is not formally their supervisor until the subsequent episode, dispenses paternalistic advice and coaches the junior CSIs in both the technical aspects of their investigation and in navigating the bureaucratic politics of the legal system. In one rather odd scene, Holly Gribbs (Chandra West), a CSI on the first day of the job, has a minor panic attack when she is left alone in the morgue. How a trained crime scene investigator is still uncomfortable to the point of panic around dead bodies is left unexplained, but as she rushes out of the morgue she is hyperventilating. Grissom, who normally displays a noticeable flatness of affect, cradles her in his arms in a perfect display of paternal comfort.

Following this incident, Gribbs is reconsidering her career choice when she goes to lunch with Catherine Willows (Marg Helgenberger), another senior CSI. Willows reassures her of the rewards of the job, promising she will feel like "King Kong on cocaine" when she solves her first case, and then explains the nature of the work that they do:

We're just a bunch of kids that are getting paid to work on puzzles. Sometimes there's a piece that's missing, sometimes you solve it in one night. The cops, forget it. They wouldn't know fingerprints from paw prints. And the detectives?

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Chase the lie. We solve. We restore peace of mind. And when you're a victim, that's everything.

In just a few sentences, Willows thus neatly links their familial orientation – as "kids" – to the need for objectivity and the failures of traditional policing to provide it. Notably, she also suggests that the underlying drive as they solve crimes is not to remove dangerous perpetrators from the street or to make the public safer, but to restore peace of mind for the victims. Even at the outset, then, the series establishes a tight link between its investigators and a victim-oriented discourse of justice.

The final act of the pilot highlights the perilous nature of the CSI universe. Gribbs, who has already been held at gunpoint once during her first day on the job, is left alone to collect evidence at a crime scene. A man approaches her, and asks if everything is okay, apparently in all earnestness. She answers in the affirmative and then returns to dusting for prints, while the camera pans to reveal a pistol tucked into the back of his waistband. A few minutes later, as the rest of the CSIs are celebrating a promotion for one of their colleagues, their shift supervisor delivers the news: Gribbs has been assaulted and shot, and is unlikely to survive. The message is clear: anyone, even a trained investigator who has graduated from the police academy, can be taken at any moment and for any reason. The subsequent episode centers on the investigation of Gribbs' murder. Willows, who feels responsible for the assault after encouraging Gribbs to stay with the position, finds some torn skin caught under her fingernails. As she recreates the attack in her head, she sees Gribbs lashing out at her assailant and explains that "She held on long enough to give us a clue." The point is thus driven home: even Gribbs knew she had no
chance for survival. None of us is ever safe: the best we can hope for is a successful identification of the perpetrator after the fact.

Some have argued that the primary ideological function of the presentation of scientific certainty in CSI is to ease over the moral uncertainties of an adversarial trial system. Hohenstein, for example, suggests that the emphasis in Law & Order (1990) on courtroom procedural dilemmas highlights American dissatisfaction with the uncertainties of criminal cases, whereas CSI offers forensic science as a provider of a quick solution to that problem by presenting evidence-based investigation as though it can achieve objectivity independent of interpretation.256 Cavender and Deutsch position CSI against the backdrop of morally ambiguous, noir-styled crime dramas, suggesting that "CSI combines the traditions of the crime genre with a new forensic realism to fuse the police and science with a convergent moral authority."257 Similarly, Byers and Johnson write that "Although they work on its behalf, as men (and secondarily women) of science, the CSIs are presented as beyond the state."258 However, in suggesting that scientists are "beyond" the state or that law enforcement can draw on science for moral authority, there is a presumption that science is perceived as both independent of the state and above moral reproach. To the contrary, the postwar US state was explicitly reconfigured as a "military-scientific-industrial" state, and as the previous chapters in this dissertation have illustrated, scientists have had anything but an unblemished record in the public eye.

258 Byers and Johnson xxiv.
While these critics are correct to point out that CSI's investigators moral relationship to state bureaucracies is a troubled one, non-scientific detectives often display the same ambivalent relationships to state policy in more traditional crime dramas. Byers and Johnson's suggestion that the CSI investigators are "neoliberal heroes [who] live by a moral code that, while not explicitly bigoted, is informed by neoconservative values through which historical matrices of power and oppression are naturalized to the point of almost complete erasure," is an astute one, but it is also largely true for contemporary crime dramas where forensic science is relegated to the background. Additionally, that part of the success of the CSI investigators with American audiences stems from the fact that they aren't restrained by liberal state bureaucracies does not undermine the legitimacy of the state per se, but of the social welfare state and of progressive restrictions on state violence. In fact, the ideological framing of CSI is overwhelmingly in favor of increased state power: it is "silly" or "irrational" restrictions on prosecutorial power and unnecessarily high evidentiary standards for search warrants that thwart both our investigators and the hard-boiled detectives in other contemporary series.

Thus, it is not from science, broadly conceived, that CSI derives its moral authority, but rather from the particularly intimate relationship between science and the state on display here. It is a science in furtherance of state interests and a state supportive of scientific inquiry at the center of CSI's moral authority. As discussed below, this relationship was rendered more explicitly in subsequent scientific procedurals through the portrayal of domesticity: as science and law enforcement literally became family

260 Byers and Johnson xiv.
members. But even in *CSI*, themes of interpersonal intimacy run deep. As Cavender and Deutsch note in their content analysis of *CSI*'s first few seasons:

In the past, a tension between a protagonist and others, even other police agencies, was a standard plot device. It set the protagonist off from others and established his (usually a man's) moral authority. *CSI* employed this plot device during its first season. It served to establish the forensic investigators as unique, as different from other police (Episode 100). We saw less of this plot device in the current season or with the spin-offs. Perhaps the series writers felt that, after many successful seasons, such tensions were no longer needed to demonstrate the uniqueness of the forensic team. *CSI* makes this point when a reporter asks an investigator, formerly in forensics but now a detective, 'Which side of the fence do you prefer'? She answers, 'It's the same side' (Episode 207) …. Forensic science blends with policing to promote the legitimacy of both spheres. Tensions still occur but they are more like disagreements among friends or family members.\(^{261}\)

Likewise, Byers and Johnson note that within *CSI*'s epistemic frame, we are left with a "truth that can only be discovered by objective forensic scientists under the guidance of the father figures of Gil Grissom, Horatio Caine, and Mac Taylor [the lead male protagonists of the three *CSI* series]."\(^{262}\)

The theme of interpersonal domestic relationships among the investigators clearly resonated with the fans as well. Although Gil Grissom and Sara Sidle, the lead male and female investigators in the original show, did not share an on-screen kiss until season ...
eight, a large contingent of fans was cheering for the relationship from the show's outset. They quickly coined the term "GSR," for "Grissom-Sara-Romance" which also served as a pun on the common CSI acronym for "gunshot residue." Countless fan fiction stories were written dedicated to the potential couple, and hundreds of fan made music videos appeared on YouTube. An entire fan website dedicated to the pairing was built around the pairing at grissomsararomance.com (subsequently shut down).

As CSI continued to demonstrate significant success in the marketplace throughout the decade, a number of imitators quickly emerged to capitalize on the fusion of scientific discourse and criminal investigation offered by the scientific procedural format. These later shows generally employed similar aesthetic techniques, including the use of computer animation and hyperverisimilitude in their reconstructions of criminal acts and multithreaded narrative plotting. In at least two cases, however, the familial subtext which surrounds the protagonists of CSI was rendered much more explicitly. The CBS series Numb3rs revolves around a literal family, in which one brother is a law enforcement agent and the other is a mathematician. While the Fox series Bones, on the other hand, initially used unresolved romantic tension to construct a familial aura, this too was transformed into a literal family as several pairs of protagonists in later seasons wed and consummated their relationships.

In contrast with many of the other scientific procedurals, Numb3rs focuses on mathematics, rather than a field traditionally understood as a branch of forensic science. The series centers on two brothers, Don and Charlie Eppes. Don is the head of the Violent Crimes Squad of the Los Angeles division of the FBI, and Charlie is a professor of mathematics at "CalSci," a fictional university modeled after the California Institute of
Technology. Charlie works as a consultant with the FBI, using a wide range of mathematical techniques from statistical analysis to game theory to assist in identifying or capturing criminals. While there are occasionally longer seasonal story arcs which deal primarily with interpersonal relationships, each episode's narrative focuses on solving a single criminal case. Unlike some of the darker turn-of-the-century police procedurals, every case is always successfully solved during the forty-three minute run time, apart from a handful of two-part cliffhanger episodes.

At a narrative level, the show implicitly and, at times, explicitly espouses a center-left progressive brand of politics. The cast is markedly multicultural and multiethnic, including the Eppes family themselves being of Jewish descent, which plays a significant role in their characterization later in the series. Charlie's graduate assistant and love interest, Amita Ramanujan, is from India, Don's second-in-command at the field office is African American, and two other field agents are of mixed racial descent. The Eppes' parents are shown in several episodes, quite sympathetically, to have been involved in anti-Vietnam War protests. In one episode, the team investigates a right-wing politician who may have fixed an election using tampered voting machines. Beyond the mathematics employed for the FBI, the merits of other scientific advances are often highlighted and the sanctity of the democratic nation-state goes more-or-less unquestioned.

The story is slightly different at an aesthetic level, however: *Numb3rs* delights in retributive violence, particularly against bodies of color. Operating in parallel with contemporary crime thrillers, African American and Latino adolescent males are regularly chased, roughed up, and/or shot at by the series' protagonists. Intense firefights

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erupt at least once in most episodes, as the audience is led to sympathize with the dispensation of violence as a means to a righteous end. As I will discuss below, the show's plotting and characterization generally eschew violent retribution, but the camera seems to revel in it.

Similar to CSI, Numb3rs adopts the aesthetic technique of using CGI interstitial scenes to represent the scientific imagination, but with a strikingly different style and purpose. In contrast with CSI's hyper-verisimilitude in reenactments of crimes as they occurred, the CGI sequences in Numb3rs generally work through metaphor to illustrate a scientific or mathematical principle. A given sequence typically begins with Charlie describing a banal phenomenon or hypothetical thought experiment, as a CGI rendering is superimposed over the diegetic space. As Charlie explains to the FBI agents (and the audience) how that phenomenon demonstrates the principle he will use for this particular case, the audience is treated to impossible freeze frames and rotations of the familiar event while numbers, diagrams, and formulas splash across the screen. For example, the primary sequence in the pilot (and reiterated by other characters in later episodes to demonstrate their own mastery of the subject) concerns a lawn sprinkler. As Charlie explains that it would be nearly impossible to calculate from the path of each drop to predict where the next one would land, a sprinkler from the Eppes' family lawn is shown and a high-speed recording of individual drops is played in slow motion as variables like wind, velocity, and pressure flash in rapid succession. Charlie then goes on to explain that while math can't practically predict the path of the next drop, it could be used to examine the pattern of past drops to determine where the water originated from. As we see the sequence play back in reverse, the drops are easily visually traceable to the original
sprinkler. Charlie then uses the same principle to successfully find a serial killer based on the locations of his killings.\footnote{"Pilot."}

These sequences are clearly imaginative in nature and not intended to directly represent any concrete reality, either within the diegetic space or without. And yet, the use of simple, common phenomena to illustrate a theoretical and highly abstracted analysis has the similar effect of \textit{CSI}'s verisimilitude in insisting on the accuracy of rational deduction to explain our circumstances. This union between the banal and the abstract as a defense of rationalism is rendered explicit during the opening narration of each episode: "We all use math every day; to predict weather, to tell time, to handle money. Math is more than formulas or equations; it's logic, it's rationality, it's using your mind to solve the biggest mysteries we know."

The narrative flow of the series is driven primarily by a back-and-forth between the FBI field agents, the faculty at CalSci, and the Eppes family. The field agents perform many of the generic elements of police procedurals such as interrogations, field interviews, chasing suspects, and engaging in firefights. Interspersed with these scenes are conversations among CalSci faculty members discussing the merits of various mathematical or scientific approaches to the crime of the week or shots of them working furiously at chalkboards or computer terminals. Finally, the Eppes' father, Alan, is also a regular character on the show, and is often used to dramatize minor familial conflicts between Don and Charlie.

For example, in the pilot episode, Don's office is pursuing a serial rapist who has recently started to brand and murder his victims. The episode opens as FBI agents interview the victims and work up a psychological profile of the perpetrator. Charlie is
introduced to the audience piloting an unpowered, aerodynamic vehicle down a city street to demonstrate CalSci's engineering prowess. After seeing a map of the locations of the attacks, Charlie explains to Don that he can develop an algorithm to help locate the perpetrator's residence based on where he is committing his crimes. As the two brothers' narrative arcs converge, police work and scientific labor begin to fuse even at the aesthetic level as shots of FBI agents following the male residents of Charlie's "hot zone" to collect discarded genetic material are overlaid with images of DNA labs and test results scrolling up the frame. After Charlie's first equation fails to achieve its purpose, Don and Charlie argue in their father's house about the efficacy of the technique, when their father Alan intercedes to suggest that they are looking at the problem the wrong way. The two brothers begin brainstorming and realize that the location of the attacks is not based just on the perpetrator's residence, but also on his place of work. With the new, revised equation, Don's team locates the perpetrator and kills him in the climactic conflict, just in time to save his most recent victim from suffocating.265

Genre mixing is certainly not new to television police procedurals. Chandler Harris has noted that as early as the 1990s police dramas were frequently featuring elements from other television genres via "double plotting." For example, he suggests that NBC's Homicide: Life on the Street often used parallel plots which followed the detectives' personal relationships and family lives to bring romantic or comedic subplots within the fold of its hard-boiled detective fiction generic conventions.266 Significantly, however, in the case of Numb3rs these disparate elements are not simply a case of intersecting plot chains. Rather, as seen in the pilot episode, the series relies on the

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cohesion of these three distinct generic elements – policing, scientific inquiry, and family drama – to move the narrative of each episode forward.

The centrality of the Eppes' family life to the investigation of criminality is highlighted again in the season one episode "Sniper Zero." The FBI is trying to identify a sniper who is seemingly selecting his victims at random, and Charlie visits the scene of one of the shootings to help calculate the origin point of a fatal bullet. When their father learns that Charlie is visiting potentially dangerous sites, he grows concerned and confronts Don in the following exchange:

ALAN: I know he's been helping you out, and he comes down to your office a lot, and I think that's great but now you've got him going out on crime scenes. I mean, there's a guy shooting people out there.

DON: You really think I would put Charlie in danger?

ALAN: You know what I really think? I think you have to understand that Charlie can never say no to you …. All you have to do is ask him something and he's there for you.

DON: Yeah, and I'm there for him.

ALAN: Look, he's not a cop. I mean, come on, he's better off with chalk in his hand than a gun.

DON: You know, you've got to stop this. He is a grown man and he is capable...

ALAN: [Interrupting] Who still seeks the approval of his older brother, whether his older brother likes it or not.

The importance of familial care is driven home during the climax of the episode, when the sniper's damaged psyche is explained to be partially a result of his absent father. At
the conclusion of the episode, Charlie visits a second crime scene and is nearly shot in the process. After the sniper is apprehended and he is safe, Don quips "Next time use the phone." In light of the focus on their brotherly connection throughout the episode, this rings as much as an admonition between family members that "You never call anymore" as it does as a warning about safe practices in criminology.267

Here the relationship between the scientist and the federal agent is configured precisely as a familial one. Charlie's motivation is foregrounded not as primarily a love of theory or scientific inquiry, but of brotherly devotion. Indeed, throughout the early seasons of the show, Charlie's mentor, a physics professor, frequently comments on the toll that his commitment to the FBI has taken on his academic work. Likewise, when a new dean is appointed to the CalSci mathematics department in season four, Charlie butts heads with her over the use of university resources for criminal cases. In fact, there is little to account for his continued dedication to the FBI apart from his connection to his brother. Charlie is a mathematical genius and an intellectual superstar on his campus, but he is frequently dismissed or ignored by the FBI field agents. While he is occasionally shown reflecting on the impact of his work in saving someone's life or finding justice for a victim, these moments are quite rare in the show.

Similarly, Don must continually defend his use of experimental models and abstract theories to both his superiors and each new batch of subordinates in the show's rotating cast. Even as early as the aforementioned pilot episode, Don is unwillingly removed from the case when Charlie's first "hot zone" fails to locate the serial rapist, and yet Don both refuses to blame Charlie and remains committed to giving his revised method another chance. His loyalty to Charlie is further demonstrated following the final

episode of season four, "When Worlds Collide," in which Charlie releases classified genetic sequencing material to a non-profit organization in Pakistan, believing that it can help address third world hunger.\textsuperscript{268} As a result, Charlie is stripped of his security clearance and unable to consult with the FBI for several episodes at the beginning of season five. Don still ardently defends Charlie and fights to reinstate his security clearance at great risk to his own career with the FBI.

Despite this obvious care for one another, the brothers frequently display sibling rivalry. Although they are four years apart in age, the two brothers graduated from high school at the same time due to Charlie's accelerated genius. Don, in contrast to his nerdy, socially awkward brother, was a star athlete in high school who maintains a social ease and charisma, particularly with women, that his brother lacks even as an adult. In addition, it is clear that there are hard feelings that the boys' mother devoted special time and attention to Charlie to help facilitate his development. In the season two episode, "Soft Target," this all comes boiling to the surface as they confront one after a mutual love interest from high school visits the men as she prepares for her own wedding. Once again, however, this plot thread is surprisingly not tangential to the primary crime narrative, but rather central to advancing it. Charlie has a key insight on how a terrorist is choosing targets while he is analyzing a seating plan for the wedding.\textsuperscript{269} Thus, the tension of the terroristic threats is subordinated to the familial tension between Don and Charlie over this childhood conflict.

The relationship of the two men to their father Alan cements the triangle of the familial relationship, as he frequently acts as both mediator and as an object of concern.

When the brothers' arguments reach their peaks, Alan steps in to calm the two down and ask them to consider one another's point of view. Additionally, given the nature of the show, the crimes frequently involve seemingly random patterns and attacks, so both Don and Charlie are shown trying to reconcile their concern for their father's vulnerability with their respective professional ethics. In the season one episode, "Vector," an outbreak of a Spanish Influenza variant suggests that someone has released a biological weapon. As Charlie is calculating the projected spread of the virus, he learns that Alan has a meeting scheduled in an area where it is likely to spread, and he is forced to decide between the FBI's mandate not to inform the public so as to avoid a panic, and his concern for his own elderly father. 270

Significantly, Alan is a retired city planner, a fact which often arises as the two brothers need to call upon his expertise. As a marked participant in civic life, Alan often functions as a stand in for the lay public. He expresses bewilderment at Charlie's math, and his outspoken political views lead him into disagreements with Don about the scope of the FBI's policing powers. Thus, the relationship here between science, the state, and the public is implicitly configured as one of intimacy and care, in other words, as the familial relationship embodied in the father and his two sons. If Charlie's math is beyond comprehension it is not because he is an intellectual elitist, but because he is committed to using every possible means to help his brother and protect his father. Likewise, when Don condones physical torture as an interrogation technique, as occurs in at least one episode, he is not shown as a sadistic fascist, but as acting out of urgent care for his family.

Despite this aesthetic of care, however, scientific law enforcement in the world of *Numb3rs*, much as with *CSI*, offers primarily retributive justice. Despite the inevitable success of Charlie and Don's combined efforts at catching criminals after the fact, neither is able to offer meaningful preventative or protective measures. Drawing on its police procedural roots, virtually every episode begins with the depiction of a violent crime or its grisly aftermath. Additionally, on at least four separate occasions, efforts to predict crime and intercede not only end in failure, but result in more harm. The theme is highlighted early in the show's run during the second episode, when Charlie nearly has a nervous breakdown after a partially correct prediction about a previously non-violent string of bank robberies results in the deaths of four people.\(^\text{271}\) In the aforementioned episode "Soft Target," a security drill to prevent terrorism at a subway station draws the ire of a disgruntled counterterrorism agent who commits several crimes.\(^\text{272}\) In season five's "Cover Me," Charlie uses supply and demand theory to attempt to take a new designer drug off the streets before it grows in popularity, but ends up placing an FBI agent's life at risk.\(^\text{273}\) Finally, Charlie is hit particularly hard when he makes a prediction about home invasions that leads to Don being stabbed, an event which haunts him for the remainder of the series.\(^\text{274}\)

Further, the series hardly offers an unblemished view of either scientists or law enforcement agents. To the contrary, corrupt scientists and police officers regularly feature as antagonists in individual episodes. Partly due to the unique plotting requirements of *Numb3rs*, which must include some way to integrate the CalSci faculty's

\(^{272}\) "Soft Target."
science and math skills into any particular case, the crimes under investigation often involve scientific research of some kind. However, when corrupt scientists appear, as they often do, they are rarely shown to act out of greed or ambition – instead, their deviance stems from the fact that, unlike the CalSci faculty, they are not properly integrated with the state, often operating with untempered zeal for scientific inquiry. The biological weapon in "Vector," for instance, is revealed to have been released not by terrorists but by a pharmaceutical researcher in an effort to demonstrate that a competitor was working with an inferior strain that would leave the public at risk.275 Another biological researcher kidnapd his cloned, adopted daughter so that he may continue studying her development.276 A young mathematician guilty of murdering his mentor is portrayed sympathetically, because the mentor's work would have harmed poor and disenfranchised communities for the sake of private gain.277

A similar dynamic is at play in the depiction of corrupt law enforcement officers. Where contemporaneous crime dramas like The Shield (2002) show local police officers skimming profits from drug busts or murdering suspected criminals to disguise their own wrongdoing, even unethical behavior by law enforcement officers in Numb3rs is for a higher moral purpose. In one episode, a fellow FBI agent who steals $10 million dollars only does so only to catch a career confidence artist.278 Similarly, "End of Watch," a season three episode, involves the investigation into a seventeen year old murder of a police officer. Don's team discovers that the officer had contacted Internal Affairs, which leads them to conclude the killer was another member of his squad. While it does indeed

275 "Vector."
turn out that the killing was to protect against an Internal Affairs investigation, the other officers were not guilty of graft but of intimidating and executing drug dealers to protect local communities. Vigilantes often appear as antagonists in the show as well, shown as guilty of pursuing retributive violence without state sanction. For example, at least three different episodes feature individuals attacking or killing childhood sexual abusers. While some of these perpetrators appear more sympathetically than others, it is made clear that any pursuit of vengeance must be checked by the official channels of state power.

Thus, both Charlie's scientific endeavors and Don's work in the interest of justice are shown to be ethically perilous when untempered. Within the context of the show, the primary restraints on each of them are each other and their father Alan – in other words, their family bonds. Here the relationship between science, the justice system, and public interest is not only reconfigured as a familial one, but the series' narrative construction systematically and repeatedly present any deviation from this arrangement as dubious at best and likely criminal. This emphasis on the mutually constitutive, interdependence of the two forces – as well as the potential ethical pitfalls of either one operating independently – are echoed strongly in the contemporaneous Bones.

As in Numb3rs, the lead protagonists in Fox's Bones (2005) are an FBI agent and a scientist who work as partners to solve crimes. The series is based on the fictional crime novels of Kathy Reichs, some of which are in turn based on her experiences as a professional forensic anthropologist consulting on criminal cases. The title character,

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Temperance "Bones" Brennan, is a forensic anthropologist modeled on Reichs herself – Reichs has claimed that she and Bones have "the same CV." Bones is a researcher at the "Jeffersonian Institute" in Washington, DC, a transparent allusion to the Smithsonian Institute. Her counterpart, FBI agent Seeley Booth, is a former military sniper and now works in the Homicide Investigations Unit. He is skeptical of the scientists at the Jeffersonian, calling them "squints" and frequently referring to what they do as "magic," despite Bones' objections on both counts. Much like Charlie and Don, they share a similar divide between the bookish, socially awkward scientist and charismatic law enforcement officer.

Each episode involves the discovery of a body, typically in a state of advanced decomposition. Bones works with her colleagues at the Jeffersonian to identify the remains and ascertain the cause of death. Her team includes Jack Hodgins, an entomologist, Angela Montenegro, a forensic artist, Camille Saroyan, a pathologist, and a rotating cast of graduate assistants and interns. In the meantime, Booth generally interrogates suspects, interviews potential witnesses, or coordinates with other federal agencies or local law enforcement offices. Once the dead body is identified and the death explained, Booth confronts and arrests the suspect. Because Bones frequently accompanies Booth to the confrontation – for reasons that are rarely explained within the narrative frame – she is often involved in violent confrontations. However, Bones' bookishness does not preclude her from fighting. It is explained that due to the rough conditions of her anthropological fieldwork, she is well-trained in self-defense and

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practices several forms of martial arts, and, as such, is typically unharmed during these confrontations.

Unlike both *Numb3rs* and *CSI*, the CGI sequences in *Bones* are not intended as imaginative, but rather take place within the diegetic space of the show. The primary mechanism for invoking these sequences involves Angela's facial reconstructions and re-enactments of traumas and impacts suffered by the discovered bodies. Angela is the apparent inventor of a three-dimensional display and simulation dubbed alternately the "Angelator" and the "Angelatron." Working from any recoverable cranial features or tips provided to her by the rest of Jeffersonian team, she delivers lifelike renderings of the victims to assist in their identification. Invariably, these reconstructions have high degrees of verisimilitude with photos of the victim once they are identified. Additionally, she runs simulations of various scenarios to determine the likelihood that particular weapons could be responsible for the wounds found on the skeletons. These simulations are stunningly accurate, ruling out even minor variations in the sequences of events that could cause the injuries. These sequences, while different in style, are thus deployed to similar effect as those found in *CSI*, insisting that forensic science is highly reliable in recreating the circumstances of a crime.

In lieu of a familial connection, the series initially develops the intimacy between the two protagonists largely through romantic tension. In the early seasons of the show, this tension is primarily subtextual and implicit. Secondary characters occasionally make suggestive comments about the pair, but they always adamantly deny any relationship beyond the professional one. Melanie Cattrell has suggested that the romantic undertones were created partly as a response to fan fiction, where there have been romantically and
sexually explicit stories written about the characters since the show's inception. However, as early as episode fifteen, the writers seem intent on making this subtext painfully obvious to the audience, when Booth grows increasingly hostile and suspicious of a male suitor pursuing Bones. Later in the same episode the two share an awkward dance scene in her apartment. In the most recent seasons, however, the relationship comes to fruition, as the two have a child and move in together to officially become a family unit.

Additionally, families, both literal and metaphorical, exert significant narrative force in *Bones*. Even prior to the consummation of their relationship, in a season four episode, Booth and Bones care for a child together after the mother is killed in an accident. The father figure during the first season, Dr. Daniel Goodman, is Bones' superior at the Jeffersonian and serves a similar narrative function to *Numb3rs*' Alan Eppes in terms of mediating both interpersonal conflicts and the competing demands of scientific inquiry and law enforcement priorities. Booth has a son, Parker, from a previous relationship and the significance of his role as a father is often discussed by other characters, even if the son is rarely seen on screen. When Angela announces that she is pregnant, she tells Bones "I hope you're excited to be an aunt." This puzzles Bones until she realizes that Angela regards her as a sister.

It is clear that the protagonists' commitment to one another, as well as to the larger metaphorical family of the Jeffersonian, drives their devotion to their work. Booth, who

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is explained as fastidious about following procedure due to his military background, regularly circumvents protocol in order to protect Bones. On one occasion, for example, he pockets evidence which may implicate her in a murder because he is certain she did not commit it. Similarly, while Bones is presented as being coldly logical and entirely devoted to her career, she sacrifices a major fellowship and a chance to discover the "missing link" when she believes it is necessary to reunite the Jeffersonian team. Angela often appears repulsed by all the work with dead bodies (despite being a specialist in forensic facial reconstruction), but remains at her post out at her post out of loyalty to Bones and the rest of the team, even returning from Paris at Bones' request.

However, family life here hardly matches the idyllic picture offered by *Numb3rs*. Bones' parents mysteriously disappeared during her adolescence, and she was subsequently raised in abusive and neglectful foster homes. As the series progresses, Bones discovers that her parents were bank robbers who abandoned her and her brother when they went on the run. Booth likewise suffered an abusive childhood at the hands of his alcoholic father and has a strained relationship with his brother. Nightmarish twists on domestic imagery abound. A Valentine's Day episode centers on the murder of a wedding planner by her husband, via being boiled alive in a tanning bed, because he feels neglected. Season four's "The Salt in the Wounds" involves a young pregnant woman who is murdered after she attempts to blackmail a doctor for money – money she needed so that she and her friends on the volleyball team, all pregnant by the same boy, could

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288 "The Mastodon in the Room."
move into a house together to live as a family. In "The Woman in the Tunnel," a former soldier, with whom Booth personally identifies, confesses that he had to shoot a pregnant woman while she was holding a child to protect his men.

Of course, the morbidity of the series extends well beyond its characterization of families. In fact, the show's premise, in which each episode centers on a victim's body that is not identifiable by conventional means, seems to push the imagery towards ever more disturbing extremes. One killer feeds his victims to dogs. Another body is found submerged in a grease truck. "The Widow's Son in the Windshield" opens with three teens driving a car until a human skull comes crashing through the windshield. A woman is incinerated in the oven of a commercial passenger jet. A millionaire is discovered dead in an industrial washing machine. And an extended story arc in season three features a cannibalistic serial killer, a practice with which Bones is well-familiar from her anthropological field work.

This imagery of the grotesque moves Bones beyond the insecurity offered by CSI or Numb3rs. While Grissom and his team can only ascertain the truth after the fact and Charlie's efforts at crime prevention or reduction regularly backfire, the characters in Bones inhabit a world of outlandish monstrosities. Crime here is not simply random and uncontrollable, but abominable to the point of nausea. The moral universe on display in these acts is one in which the only possible response, once the squints have determined exactly what happened, is immediate and violent retribution. Indeed, it is the drive for

293 "Two Bodies in the Lab."
vengeance that ultimately ties the otherwise nice Jeffersonian family together, as is made explicit when Bones questions Booth about why he is so nice to her, and he responds:

Because they think they get away with it ... They burn their victim, they blow him up, they toss him into the ocean, they bury them in the desert, they throw them into wood chippers. Sometimes, you know, years go by, and they relax. Then they start living their lives like they didn't do anything wrong, like they didn't spend someone else's life in order to get what they got. They think they're safe from retribution, but you make those bastards unsafe. That's why I'm nice to you.²⁹⁸

This sentiment is later echoed when Hodgins returns with his wife Angela from a seemingly idyllic life in Paris. After she informs him that she's pregnant, they discuss whether it would be better to return to Paris or stay in Washington, DC. When they settle on staying, he proclaims his excitement because "catching bad guys is what I do."²⁹⁹

Here, again, family, forensic science, and retribution are presented as mutually constitutive.

However, it is made clear that these activities only achieve their proper moral functions within the union between science and justice under the framework of the state. While Bones does not feature storylines that center on either scientists or law enforcement officers as frequently as Numb3rs, two of the primary recurring antagonists highlight the dangers of operating outside of this context.

Dr. Zack Addy served as Bones' assistant during the show's first three seasons. He was portrayed as both exceptionally intelligent and extremely socially awkward, even by the standards of the Jeffersonian staff. During much of season three, the team is chasing

²⁹⁸ "The Man in the Morgue."
²⁹⁹ "The Mastodon in the Room."
a cannibalistic serial killer who is receiving help from an unknown apprentice. In the season finale, it is revealed that Zack is the mysterious apprentice, and he had manipulated evidence and caused distractions on the killer's behalf. Significantly, however, when he is finally confronted by Bones, Zack discloses that he assisted the killer not because he was himself sadistic or sociopathic, but because he believed in the infallibility of his own logic. In a melodramatic scene, Bones explains that the flaw he overlooked in his logic was the strength of his own connection to his fellow team member, Hodgins, and presumably the rest of the Jeffersonian staff.³⁰⁰

In a similar season-long arc, a sniper is murdering violent criminals who have escaped justice. The sniper's identity is soon discovered to be Jacob Broadsky, an army associate of Booth's. The parallels between Broadsky and Booth are explicitly referenced in one of his first appearances, when Broadsky tells Booth "We're the same, Seeley. We both want to do the right thing."³⁰¹ Further, Booth spends the better part of another episode worrying that Bones views his motives as essentially the same as Broadsky's. Broadsky, however, is interested only in killing those who have transgressed: untempered by Booth's connection to his community, he begins killing innocents who are in his way or otherwise interfere with his pursuit of vengeance.

Here, then, we have images of what both Bones and Booth might look like without their connections to one another and the Jeffersonian family. Bones' cold affect and absurdist hyperrationality, much like Zack's, runs the risk of arrogance bordering on the sociopathic, while Booth's pursuit of justice would lead to blind murder without the guidance of his squints. Instead, their moral authority derives from the relationship

between the two, that is, from the union of science and the state in the pursuit of retributive justice.

**Conclusion**

Presenting the relationship between forensic science and law enforcement in the form of embodied, intimate, and familial connections thus negotiates a complex set of meanings. It not only transforms the public body into a distinctly private family, but it presents the private world as constantly vulnerable and under threat. Shows like *Numb3rs* and *Bones* offer a diverse cast of protagonists which cuts across racial and gendered lines to imagine a multicultural national family, while simultaneously presenting a Manichean world in which absolute evil waits around every corner. They offer the thrills of sadistic violence with the simultaneous assurance that when such violence is committed by the state it is delivered precisely and surgically to the right targets. Put simply, they position that family as the perfect subjects for the War on Terror and offers Agamben's state of exception as the only feasible response to the constant threat of violence.

But perhaps most significantly, in their construction of forensic science and law enforcement agents as a singular family, scientific procedurals also perform the significant discursive work of smoothing over the gap between scientific and juridicolegal epistemological frameworks. As the NAS noted in their report, scientific discovery is rooted at the most fundamental level in a spirit of continual inquiry, whereas society has an expectation of finality in legal proceedings – particularly criminal ones. Curiously, within the discursive realm of the scientific procedural, the former, open-ended epistemology is presented as the guarantor of the latter's certainty. That is, at the
conclusion of each episode, we know that the right person is in prison precisely because the scientist has "proven" their guilt.

Despite the assurances offered by the scientific procedural, however, in the absence of any significant effort to reform standards for forensic science, the distinction between these two modes of truth-finding continues to present significant challenges to the certitude of criminal convictions. In 2009, the Supreme Court heard arguments in the case of William G. Osborne, who was convicted in 1993 of raping and beating a woman in Alaska and sentenced to 26 years in prison. Osborne was seeking access to a semen sample which had been used by the prosecution during his trial on the grounds that newer, more accurate, DNA tests could reveal his innocence. The Anchorage District Attorney, however, refused to turn over the sample, on the grounds that he was convicted based on eyewitness and accomplice testimony, rather than solely or primarily on the scientific evidence. Following the Supreme Court oral arguments, legal scholar Erica Goldberg noted that the Court's quandary stemmed from the problem that "To deny Osborne his DNA evidence would allow a state to arbitrarily deprive a prisoner of valuable scientific evidence, and deprive the justice system of important truth-determining tools. But to allow Osborne his DNA evidence would compromise the finality of all convictions involving scientific evidence."302

US Supreme Court Chief Justice John Roberts, writing the opinion for the majority, appeared to be much more concerned with the question of finality, holding that prisoners have no fundamental due process right to reexamine scientific evidence. Although the Court left a narrow window open by declining to rule as to whether such a

fundamental right would exist under a *habeas corpus* claim – a more protracted, final legal claim for wrongly imprisoned individuals – a number of critics observed that the Court failed to take the opportunity to clarify the role of forensic evidence and the rights surrounding its use. Justice Roberts, in particular, seemed reluctant that any such reform should come from the judiciary and expressed his concern that exonerations based on forensic evidence risked "unnecessarily" upending the established justice system. In response, law professor Kevin Jon Heller quite rightly quipped that "It might lead to a reasonably accurate one."

The Osborne decision may be read in large part as a rebuke of the Innocence Project, as well as a failure of the Court to reconsider the relationship between the law and forensic sciences. But the continuing absence of reform from both the legislature and the judiciary is enabled by – and ultimately an affirmation of – the moral framework offered by scientific procedurals. This framework subsumes the search for truth into the need for certainty and the quest for justice into the satisfaction of retribution. As noted above, these serials are hardly alone in advancing this imaginative frame in post-9/11 American culture, but they nevertheless play a critical role in negotiating the contested terrain between scientific and legal rhetorics.

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Conclusion

After the US presidential election of 2008, a number of suggestions emerged that Barack Obama might be the first "nerd president" of the modern era. Technology website Wired ran articles like "5 Signs President-Elect Obama Is a Geek," while the Associated Press wondered whether he might not just be "nerd-adjacent." These suggestions were based primarily on the president's fondness for particular strands of popular culture – notably the Star Trek television series and Spiderman comic books – but also called on his fondness for technology, including his BlackberryTM smartphone and the thorough integration of social media technologies in his successful campaign. A number of observers hoped that these interests would translate into political commitments for more robust investments in science and technology research. That a sitting president with such a widely hailed charismatic presence was hailed as a nerd demonstrates a dramatic evolution in the term away from its previous roots in social awkwardness.

And yet, certain elements of the mythologized nerd seemed to persist, even in discussions of the President. At the 2009 Radio and Television Correspondents' Dinner, television comic John Hodgman quizzed President Obama on his nerd credentials by testing his cultural knowledge of Star Trek, comic books, and fantasy literature. Throughout the piece, Hodgman both draws on and lampoons the notion that nerds are socially victimized. He identifies himself as a "middle-aged, round-faced, weak-chinned nerd," and stops at one point to use an asthma inhaler, to the delight of the crowd, but also highlights his own privilege as a television personality and satirically refers to his "modest upbringing" in a sixteen room home. He goes on to describe Obama as "born of

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two worlds," in a seeming reference to his biracial parentage, but then subsumes that racial division into the suggestion that the president might be both a jock and a nerd. In a sendup of the controversies surrounding the president's birth certificate, Hodgman worries that Obama's nerdish characteristics might just be an affectation, because "there is no documentation of his existing before this very night," again linking the president's status as a nerd to his racial identity. Twice mentioning Revenge of the Nerds during his speech, Hodgman was, knowingly or not, reinvoking the subtextual links between nerds, race, and victimization that run throughout the film.\footnote{Craig Newmark. "John Hodgman: Obama Is the First Nerd President." The Huffington Post. 20 June 2009. Web. 29 Apr. 2011.}

Hodgman ends the piece on a hopeful note. Having earlier described nerds as not merely "people who are good at math," but people who approach the world with a philosophical spirit of inquiry, he suggests that Obama may do well to return some of that spirit to the White House. In April 2009, just three months after taking office, the newly-elected president addressed some of the hopes that his nerdish inclinations would lead him to expand the federal role in science during his remarks to the annual meeting of the National Academy of Sciences. Aimed at the crowd of gathered scientists, he pledged to expand the federal research budget, including doubling the budget of the NSF and tripling its graduate fellowship program, even in the face of constrained federal funds following the 2008 financial crisis. Additionally, in an echo of much of the logic espoused by Vannevar Bush in The Endless Frontier, the speech highlighted the notion that research was an area that the private sector would and could not adequately fund without public intervention. Obama repeatedly referred to the high-risk, high-reward nature of basic science, suggesting that these kinds of inquiries offer no guarantee of practical results and
that even when they do yield returns, those effects may not be patentable or profitable. In essence, he was making a pitch for a renewed devotion to scientific inquiry as a foundational commitment of public interest.

He also suggested, perhaps as a barb against the previous administration, that he would give greater autonomy and authority to scientists within state agencies, saying "[W]e are restoring science to its rightful place … Under my administration, the days of science taking a back seat to ideology are over. Our progress as a nation – and our values as a nation – are rooted in free and open inquiry. To undermine scientific integrity is to undermine our democracy. It is contrary to our way of life." He further symbolically emphasized this autonomy by highlighting his appointment of Steven Chu, a Nobel Prize winning physicist, as the Secretary of Energy, and an executive memorandum which dictated that professional appointments to scientific positions in government should be determined solely by "technological knowledge, credentials, experience, and integrity."

Notably, despite opening with a mention of the NAS' establishment during the Civil War, the primary historical frame of reference for the speech to the NAS was the 1950s and 1960s. The text is overflowing with references to the Apollo missions, the creation of the NSF, and the National Defense Education Act. Eisenhower, Kennedy, and Vannevar Bush, rather than Lincoln, are the historical actors Obama cites for evidence of America's "enduring optimism" in scientific research. It is evident that the figure of the public scientist Obama calls on here, as both a beacon of progress and a rational, neutral arbiter, emerges from this era and the evolution of the state-funded scientific

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bureaucracies described throughout this dissertation. Moreover, he positions the federal commitment to science not as a question of scientific inquiry alone, but instead highlights the improvements to daily life that have resulted from these investments.

However, despite Obama's call to depoliticize scientific inquiry, the subjectivity and politicization of scientists plagued his first several years in office. A number of high-profile scandals swirled around the funding and potentially politically-motivated conclusions of scientists, particularly concerning renewable energy and climate change, the central planks of Obama's science and technology platform. The twin ideas behind global warming – 1) that global climate change is a significant problem, and 2) that human activity is the major contributing force to that change – have had dissenters, both within and outside the scientific community, since their initial recognition as a serious concern in the 1980s. However, in the early twenty-first century, both the promoters and detractors of global warming came under fire for not just the reliability of their scientific conclusions, but for the perceived political subjectivities from which those conclusions originated.

The first of these scandals, dubbed "Climategate" in the popular press, concerned a series of emails between climate researchers which were illicitly retrieved in 2009 from the Climatic Research Unit (CRU) at the University of East Anglia in the United Kingdom. The emails, intended to be read by other climate scientists, mentioned using "tricks" to alter their data and threatened to "redefine what the peer-review literature is" to remove particular papers out of a United Nations report on climate change. Conservative bloggers and media outlets took these as indications of intentional data manipulation, suggesting that climate scientists were exaggerating their results or hiding
evidence to serve particular political ends and keep a steady stream of funding for their research. Although these emails were largely taken out of context – "trick," for example, referred to a clever way to present data, rather than an intent to deceive or manipulate – they left a lasting impression that politically-motivated climate scientists were abusing their power to keep opposing views from receiving public attention.

The following year, historians Naomi Oreskes and Erik Conway released their bestselling text, *Merchants of Doubt*. Focusing primarily on two well-placed, politically conservative physicists, Fred Seitz and Fred Singer, they alleged that a handful of scientists had deliberately obfuscated public understanding of the science involved on political issues ranging from the effects of tobacco smoke to climate change. Seitz, the former head of the NAS, and Singer, a former deputy assistant secretary with the Department of the Interior, conducted research for, consulted with, and founded a variety of think tanks and initiatives expressing skepticism about human contributions to global climate change. According to Oreskes and Conway, they were driven largely by free-market fundamentalism, and their resistance to any potential benefits from government regulation colored the results of their research. They further used their positions to establish an air of authority in the popular press, even where they were speaking against scientific consensus. Here, left-leaning media, science critics, and bloggers had their authoritative counter-punch to the Climategate controversy, in which it was the climate science deniers being driven by ideological commitments rather than an allegiance to the evidence.

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By pointing out the parallels in these two cases here, I do not mean to suggest a false equivalency between them. Indeed, as Oresky and Conway point out, one of the principal aims in manufacturing doubt is to lend credence to the notion that there are two sides to every scientific story. Multiple independent inquiries – from the Environmental Protection Agency, the National Science Foundation, and the Department of Commerce – found no scientific misconduct in the so-called "Climategate" case, and further held that the seemingly inflammatory statements within the emails were, in fact, received out-of-context and mostly benign. On the other hand, while there should certainly be room for skeptical voices in the scientific community, it seems evident that it is not Singer's or Seitz' original or contrarian research that garners them such frequent citation in the popular press, but the air of authority that they lend to the manufactured controversy.

I place the two together here to highlight the common elements in popular reaction, rather than argue that they exist on an equal scientific footing. As one commenter in Nature noted, "One lesson that must be taken from Climategate is that scientists do not get to define the terms by which others see them and their place in society."\(^\text{311}\) In both cases, elements of the public and the popular press appeared ready to embrace the notion that scientific inquiry was not rooted in dispassionate observation, but in prior social and political allegiances. Further, the popular characterization of the scientists in each of these instances was that they were willing and able to use their highly specialized, esoteric knowledge to manipulate an unwitting public. Despite the Obama administration's suggestion that we return to an era in which science can be neatly divided from ideology, it seems clear that the myth of objective scientists committed to a collective public good was in retreat.

As discussed in chapters four and five, the popular imagination of scientists had substantially transformed from throughout the latter half of the twentieth century towards a more individually-motivated framework. Here, in the controversies surrounding climate change, was some of the major fallout of that transformation: the belief that the entire scientific community was motivated primarily or entirely by their political allegiances, rather than a genuine interest in expanding our understanding, solving collective problems, or improving our quality of life. It is healthy, I would suggest, for a culture to have a certain amount of skepticism about claims of scientific truth: an unfailing belief in science inhibits the capacity for critical inquiry, and allows for hucksterism of the worst kind. Or, in even worse cases, it leads to the abuses of trust and power that enabled the grossly exploitative conditions under the Tuskegee syphilis experiments. On the other hand, the problem, of course, with a turn towards complete cynicism is that, as the problem of global climate change aptly demonstrates, there are realities, sometimes with grave effects, that are not waiting on or contingent upon politically situated knowledge. Science and scientific discourse represents one of our most basic, shared epistemic frames for addressing these problems. When science is treated as just another tool for base factionalism, we lose one of the major deliberative arenas through which we might come to a common understanding. Thus, while it is important to question the origins of scientific knowledge, a society must also, at a certain point, be able to move beyond that question in order to take collective action.

Part of this cynicism stems from the perceived gap between scientists and the larger public. The professionalization and bureaucratization of science and scientists in the United States throughout the latter half of the twentieth century did wonders in terms
of increasing the resources allocated to scientific and technological development, but it also cemented the notion of scientists as a class apart. As I’ve demonstrated throughout this dissertation, this scientific class has been imaginatively configured in various relations – both benevolent and not – to the lay public, but as separate, nonetheless. As seen in the fears of political manipulation during the Oppenheimer trial or of callous disregard for human subjects in the Tuskegee experiment, that separation frequently interrupted and provided a sharp disjuncture to narratives of the universality of "scientific progress" throughout this period.

A brief sketch from the satirical television pundit Steven Colbert helps illustrate the enduring imaginative power of this gap between scientists and the lay public. The segment, "The Enemy Within," opens with Colbert narrating that there are "those among us intent on challenging our most sacred beliefs, no matter what the costs. They call themselves scientists." The events described concern a minor human interest news story from a coastal Maine town, in which a local scallop fisherman misplaced a tub of scallop parts intended for delivery to "Dr." Skylar Bayer, a marine biologist at the University of Maine. Though everyone interviewed for the story, from the police chief to the fisherman, asserts that this was simple case of lost-and-found, Colbert repeatedly suggests that something more nefarious is at work. As Bayer explains her research into scallop reproductivity rates, Colbert repeatedly questions her with disbelief. None of the other interviewees, including the police chief, the fisherman, and the teacher who found the scallop parts are met with the same level of suspicion. Describing Bayer as a "lonely lady scientist," he concludes that the only possible explanation for her interest in scallop

312 Within the segment, Bayer quickly notes that she has not yet completed her Ph.D., but to continue the satire Colbert insists on calling her "Dr. Bayer" nonetheless.
reproduction is to construct a half-human, half-scallop hybrid to socialize with. His explanation of the human-scallop hybrid scheme is narrated over a visual backdrop assembled from black-and-white science fiction films and contemporary news stories about genetically modified organisms. Clearly, Colbert's piece is highly satirical, but it is also entirely dependent on underlying cultural anxieties about the remove between scientists and the lay public: the joke only works as well as it does because of that perceived gap.

However, as much as the piece relies on the idea that scientists are manipulating an unsuspecting public toward their own ends, the use of comedic parody also helps to belie that notion. Throughout the sketch, Bayer is particularly adept at playing the straight woman, as she responds simply and directly to his repeated accusations that there is more to the story. As Colbert questions her about whether or not she "intends to destroy the human race," it is evident that she is barely able to contain a laugh. Following the airing of this episode, Bayer noted on her blog that the Colbert piece was a success, and that "this story made science more accessible to the public and that it depicts a scientist (me) as any other person with a sense of humor."314

In the connection between humanization and accessibility, one can't help but be reminded of key moments in the postwar era relationship between science and the state. Oppenheimer before his trial, for example, was celebrated not just for his scientific or administrative accomplishments, but as a lover of horseback riding and an advocate for free access to information. Or the Gemini and Apollo astronauts, whose family and domestic lives were profiled in great detail as part of a tremendous public relations

campaign from NASA. These were hallmarks of the most popularly successful unions between public interest and the state research bureaucracies not just because of fruitful scientific inquiry, but because in these moments the state agencies, the scientists involved, the journalistic media who reported on them, and the popular fictions that celebrated them were effective in creating a structure of feeling in which scientists were viewed as fully integrated members of the body politic.

In the early twenty-first century, there are nascent efforts to reinvigorate the material connection between the professional science community and the lay public. In particular, there have been a number of projects from the scientific community to enhance the accessibility of their work and more fully integrate the public. Although Open Access publishing, in which peer-reviewed scientific works are made freely available to interested readers, has existed in limited forms for decades, it has gained a significant amount of clout as a political movement in the twenty-first century. In 2000, the Public Library of Science was founded as a non-profit publisher with the mission of disseminating freely available scientific and medical materials. The following year, over 34,000 scientists signed their pledge to only publish in journals which grant unrestricted distribution rights. Simultaneously, there has been an embrace of "crowdsourced" research which more directly engages interested members of the public in actively contributing to scientific projects. Crowdsourcing is, in essence, a distributed problem-solving model in which a large project is typically divided into small, quickly digestible tasks. These tasks are then publicly broadcast to and solved by volunteers. Thus, the originating individual or institution (the crowdsourcer) may, if they are able to capture public interest and acquire enough volunteers, solve problems at scales well beyond their
own capacity, while paying only the costs of establishing the communication
infrastructure and administrating/collating the results. The uses of crowdsourcing for
scientific problems have varied greatly in both the kinds of research being conducted and
the nature of tasks distributed to the public participants. Some participation is largely
passive, as with the proof-of-concept work in SETI@Home, which called for volunteers
to donate unused computing cycles to analyze millions of recorded signals from radio
telescopes. More recently, there is an increasing push to distribute human cognitive tasks
through crowdsourcing, such as Biogames' MOLT (2012), which has users diagnose
images of blood cells for potential malaria infections, and the University of Washington's
Foldit (2008), in which users fold virtual proteins so that biochemists may better predict
protein structures. It is unclear, at this juncture, to what extent either of these will engage
the popular imagination, but they will undoubtedly prove important areas of research for
better understanding the relationship between science, the state, and the lay public in the
twenty-first century.

One thing that does seem certain is that science and technology will play an ever-
increasing role in our daily lives. If there is one lesson to be taken from the past seventy
years of the state-scientific bureaucracies, however, it is that the meaning of that role is
far from determined. While a typical citizen or consumer may not have an intimate
understanding of a particle accelerator's mechanics or the physical makeup of an Internet
exchange point, they still have a host of very valid questions about their construction:
Who is building these? Who will control them? Who will benefit from them? How will
they alter our daily lives? The answers to these questions are not a fixed result of the
research or artifact itself, but are instead constantly, and sometimes violently,
renegotiated in political, social, and cultural terms. When scientists appear on the screen or on the page, it is precisely this negotiation that is taking place: the struggle to determine what scientific knowledge and technological progress can, should, or will mean.

Throughout this dissertation, I have argued that the popular imagination of scientists has played a central role in how we answer these questions. My primary drive in doing so has been to demonstrate that those answers matter not only to the manner in which we might conduct scientific research, but to how we frame, understand, and create meaning about the nature and character of the relationship between the state and the public. The goal here has been to show that culture not only "reflects" some external material or political force, but that it is itself historically productive. The scientists, politicians, cultural producers, and consumers described herein each had their own sets of motivations, allegiances, and interests, which were often uncoordinated and sometimes at cross purposes. Nevertheless, their encounters and collisions crafted a shared discourse which in turn acted upon the world by shaping the material and political relations surrounding scientific research and technological development. To very loosely paraphrase the great Sun Ra, the stories we tell, the images we produce, and the songs we share do not just describe or comment upon the world we live in: they create a new one.
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