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WILLY LEY, THE SCIENCE WRITERS, AND THE POPULAR REENCHANTMENT OF SCIENCE

A DISSERTATION APPROVED FOR THE
DEPARTMENT OF HISTORY OF SCIENCE

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Abstract

This dissertation explores the life and career of Willy Ley, a science writer and popularizer of spaceflight technology in Germany and the United States during the twentieth century. By following his various "campaigns" to popularize a future of interplanetary travel and promote a vision of science that was inclusive and open, this dissertation highlights the cultural influence of an intermediary and "outsider," who operated as a media-savvy scientific celebrity. A focus on Ley as an important figure in the history of technology helps to correct an imbalance in existing historiography, which traditionally sheds light on engineers, astronauts, and politicians. It demonstrates that the history of spaceflight is a history of media, popular representations, and artifacts. Additionally, it situates the history of spaceflight within broader avenues of science popularization, which could include efforts to celebrate the future of technology, as well as the past accomplishments of scientists and engineers. An analysis of Ley's books, tactics, and perspectives will demonstrate that histories of popular science should include key efforts to popularize the history of science. These efforts will help to reveal the open, cosmopolitan, and socially engaged roots of an academic discipline, particularly in the publishing world of New York City during the Second World War and early Cold War. A focus on Ley will help to contextualize the maturation of the history of science, by relocating our perspectives from a narrow view of disciplinary formation to a broader appreciation of the circulation of texts, ideas, and representations. A biography of Ley serves as a case study that will invite further revisions to many traditional narratives.

Introduction

This dissertation explores the life and work of a man who defies classification. He was a "scientist" who rarely practiced science. He was a "rocket engineer" who rarely designed. He was a "prophet" who predicted the future, yet simultaneously acted as a "historian of science" looking to the past. He was a "modernist" who celebrated the "conquest" of nature, grand engineering redesigns, and the future. Yet, he was also a "romantic" who searched for wholeness, expressed deference in the presence of awe and wonder, and voiced nostalgia for a time when science was more open to all. He was an "outsider" who was also an "insider." He was both an "amateur" and an "expert."

On an occupational level, it is most accurate to describe him as a "science writer," because the term encompassed every book and article that he wrote during his lifetime. One could use this term interchangeably with "science educator," so long as the realms of education are recognized as broad, popular, and media-savvy. Yet, if there is one label that Willy Ley embraced, it was that of a "romantic naturalist." One might also use the labels of "modern romantic" or "romantic modernist" to describe Willy Ley. He was a naturalist who embraced wonder, awe, and the mysteries of nature. Simultaneously, his romance with nature included a drive to unmask, conquer, reorder, and master. A scholar might adopt gendered terms here. Ley stood enchanted by the beauty and wonder of Nature, just as he sought to possess and objectify her treasures.

One could argue that he was a man of contradictions. For example, he trusted eyewitness accounts of the "abominable snowman," while he dismissed eyewitness accounts of "UFOs." He celebrated the great unknowns of nature, while he relentlessly debunked the myths and legends surrounding great unknowns. He possessed an

unflinching imagination, restrained by a skeptical mind. He celebrated great leaps into the unknowns of science, yet warred against the pitfalls of such intuitive leaps. He democratized science, while he cherished the utility of expertise. He embraced mass media, while he campaigned against certain best-selling books and other "propaganda."

This dissertation highlights the ways in which Ley's perspectives illustrate the complexities of a "modern form of enchantment."[1] As scholar Michael Saler and others have argued, we can recognize the variety of cultural practices that did not simply rebel against a "disenchanted" modernity. Instead, we can appreciate how certain genres of writing sought to "complement it—to secure the marvels that a disenchanted modernity seemed to undermine, while remaining true to the tenets intellectuals ascribed to modernity at the time, such as rationality and secularism."[2] Certain writers voiced "a solution to the crisis of modern disenchantment."[3] They tapped into the "widely felt need of the period for forms of wonder and spirituality that accorded with reason and science…"[4] Their works offered transcendental meaning, wonder, awe, and reverence for the great unknowns. Yet, simultaneously, they could promote empiricism, skepticism, and the explicability of nature.

Saler makes these points to highlight the popularity of "virtual worlds" that offered safe places for imaginative and playful, yet still restrained enchantment. Yet, his broader points about scholarly revisions are important. Science has often been seen as the central component of "disenchantment," as scientific thinkers waged wars against

[1] Michael Saler, *As If: Modern Enchantment and the Literary Prehistory of Virtual Reality* (Oxford and New York: Oxford University Press, 2012).
[2] Saler, 7.
[3] Ibid.
[4] Ibid.

superstition, mystical thinking, revelation, and magic.[5] A naturalistic, mechanistic, or secular worldview stripped away the mysteries to reveal a universe destined for conquest and control. Reason and empiricism triumphed over intuition and revelation. In the famous perspective of Max Weber, modern life offered an "iron cage," barren and soulless. Wonder and surprise became the relics of a medieval past. These anachronisms could also be seen as "living fossils," now gasping for air in vulgar, popular realms. As Saler noted, "Wonders and marvels were relegated by elites to the ghettos of popular culture… and the new mass culture."[6] In traditional accounts, magic was ultimately destined to fade in the face of a "narrow, instrumental rationality and a hollow, expanding secularism…"[7]

In recent years, scholars have interrogated and undermined this conception of modernity, both in its original "binary" distinctions and its "dialectical" reformations by social critics.[8] Instead of offering a narrative of triumph, progress, or disenchantment, several scholars now recognize that modernity is best understood by the "fruitful tensions between seemingly irreconcilable forces and ideas."[9] The unresolved contradictions, the overlapping opposites, and the competing surfaces contributed to a modernity that was "Janus-faced."[10] Science and technology played key roles in this realm of competing representations and contradictory discourse. As David Nye showed in *American Technological Sublime* (1994), technological marvels could provoke "an essentially religious feeling," despite being the hallmarks of man's conquest of nature

[5] For an interesting history of romantic rebellion, see James William Gibson, *A Reenchanted World: The Quest for a New Kinship with Nature* (New York: Henry Holt and Company, 2009).
[6] Michael Saler, "Modernity and Enchantment: A Historiographic Review," *The American Historical Review* 111 (2006): 696.
[7] Saler, *As If*, 9.
[8] For a historiographic overview, see Saler, "Modernity and Enchantment," 692-716.
[9] Saler, *As If*, 12.
[10] Ibid.

and enlightenment from a mystical past.[11] Nye argued, "In a physical world that is increasingly desacralized, the sublime represents a way to reinvest the landscape and the works of men with transcendental significance."[12] While Nye sees this tradition as strongest in the United States, he offers yet another example of widespread reconciliation between two ideological extremes, as modernity became increasingly complex and even contradictory.

Simultaneously, recent scholars have demonstrated a similar reconciliation within science. For example, Richard Holmes' bestseller *The Age of Wonder* explored "romantic science," as it flourished during the eighteenth and nineteenth centuries.[13] Holmes wrote, "It was a movement that grew out of eighteenth-century Enlightenment rationalism, but largely transformed it, by bringing a new imaginative intensity and excitement to scientific work. It was driven by a common ideal of intense, even reckless, personal commitment to discovery."[14] Although Holmes identifies a limited lifespan of "romantic science," he also demonstrates how so many tropes surrounding its image of the scientist as a heroic, daring, and even spiritual adventurer survived intact, despite many competing representations. Holmes also pleads for "not only a new history of science, but a more enlarged and imaginative biographical writing about individual scientists… We need to explore what makes scientists creative…"[15]

Other scholars have charted the survival (or revival) of romantic science in the twentieth century. Notably, Martin Halliwell's *Romantic Science and the Experience of*

[11] David Nye, *American Technological Sublime* (New Bakersville: The MIT Press, 1994), xiii.
[12] Ibid.
[13] Richard Holmes, *The Age of Wonder: The Romantic Generation and the Discovery of the Beauty and Terror of Science* (New York: Pantheon, 2008).
[14] Ibid., xvi.
[15] Ibid., 468-469.

Self (1999) argued that the movement attempted "to regalvanize the spirit of late eighteenth-century and early nineteenth-century German romanticism in which there was no strict division between art and natural science."[16] Scientists attempted to recapture the human elements and the subjective experiences, without rejecting the mechanical realities of an orderly universe. Despite the complexities and contradictions between different camps of scientists, there was an "internal coherence to the genre of romantic science as each subsequent writer reinterprets the terms of the discourse..."[17] The romantics also focused on "selfhood as the vehicle for understanding and expression while retaining a firm focus on empirical reality."[18] Halliwell views this discourse in terms of scientific specialization and practicing scientists. Thus, he identifies the genre, in part, by a type of "inquiry into selfhood (encompassing philosophical anthropology), aesthetic responses, phenomenological description and behavioural observation."[19]

The reconciliation between extremes was widespread, particularly in Germany, where Ley spent his early years. Given long traditions of *Naturphilosophie* that valued the role of speculation and wonder, Germans could "speak of Romantic science and medicine side by side with literature and the other arts."[20] While this could be seen as a "metaphysical form of scientific research," it seems far more correct to identify it as an attitude or sensibility, reflected in both practices and ideas that circulated beyond the laboratory or research center.

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[16] Martin Halliwell, *Romantic Science and the Experience of Self: Transatlantic Crosscurrents from William James to Oliver Cromwell*, Studies in European Cultural Transition, vol. 2 (Aldershot: Ashgate, 1999), vii.
[17] Ibid., 15.
[18] Ibid., 14.
[19] Ibid.
[20] Dietrich von Engelhart, "Romanticism in Germany," in Roy Porter and Mikulas Teich, eds., *Romanticism in National Context* (Cambridge: Cambridge University Press, 1988), 111.

These practices and their resulting publications found a broader audience, not only in Europe but also in the United States. When many scholars investigated the cross-cultural currents in more depth, the story became much broader and transnational. In *The Humboldt Current: Nineteenth-century Exploration and the Roots of American Environmentalism* (2006), Aaron Sachs explored and celebrated the popularity of a Humboldtian cosmos in the United States.[21] Sachs argued that Humboldt offered "a powerful alternative."[22] Americans, like their German counterparts, appreciated his "deep feeling of awe and appreciation for the great variety of landscapes and cultures."[23] Humboldt offered his readers a romantic naturalism and an ecological awareness, in which "Nature offered not only deep insights but also solace and sanctuary; the very image of a wild and overgrown landscape could move people spiritually, was perhaps even more valuable in times of need than religion."[24] Humboldt's works offered a daring interdisciplinary mix of science, art, wonder, and poetry. He inspired readers to "worship… not whatever force might have been responsible for the cosmos, but the cosmos itself, the beautiful whole that could not exist without each of its parts, the overall community of which human beings were members."[25] "In the person of Humboldt," a different scholar noted, "the explorer embodied the Romantic hero."[26]

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[21] Aaron Sachs, *The Humboldt Current: Nineteenth-Century Exploration and the Roots of American Environmentalism* (New York: Viking, 2006).
[22] Ibid.
[23] Ibid., 13
[24] Ibid., 45.
[25] Ibid., 76.
[26] Stephen J. Pyne, "Seeking Newer Worlds: An Historical Context for Space Exploration," in *Critical Issues in the History of Spaceflight*, eds. Stephen J. Dick and Roger D. Launius (Washington, DC: National Aeronautics and Space Administration, 2006), 23. In Pyne's perspective, the Humboldtian explorer was a dying breed in the early twentieth century.

In Sachs' perspective, Humboldt's ecological worldview was an "intellectual torrent that swept through the Western world—the United States in particular—for about a century, before it evaporated in the desert heat of social Darwinism, which endorsed both human and environmental exploitation."[27] The modernists who followed showed little reverence for nature, which became a site for violent conquest in the service of mankind. The scientific disciplines, we are told, showed little tolerance for romance, wonder, and speculation. Likewise, Stephen J. Pyne sees the Humboldtian explorer as a living fossil by the time of the Great War. He argued, "There was nowhere else for the Humboldtian explorer to go. Equally, there were no more lands to meaningfully colonize."[28] He continued, "Instead, Europe turned upon itself in near self-immolation, with two world wars, a depression, and the sudden shedding of its old imperialism. The enthusiasm for boundary surveys and natural-history excursions—for imperialism itself—waned with the slaughter of the Great War."[29]

Yet, if the works of Willy Ley are indicative of a larger trend, the Humboldtian cosmos survived, at least partially. Modern romantics, like Ley, continued to celebrate the beauty of Nature and the interdisciplinary combinations of science and art. They glorified Nature, even as they drew modernist designs for their conquest and exploitation of "her." As these interdisciplinary endeavors moved seamlessly into the twentieth century, these scientific intellectuals sought to reconcile two extremes, while they kept the door open, so others could follow. Popular science writers, especially Ley, fearlessly mixed genres and messages in a way that promoted both conquest and reverence for Nature.

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[27] Sachs, *The Humboldt Current*, 13.
[28] Pyne, "Seeking Newer Worlds," in *Critical Issues*, 25.
[29] Ibid.

One of the central goals of this dissertation is to illustrate this continuity, in which the "notion of an infinite, mysterious Nature, waiting to be discovered, or seduced into revealing all her secrets, was widely held."[30] Many variants of a spiritually-fulfilling naturalism found expression, particularly in Germany and the United States. While many intellectuals embraced a quest for wholeness (in contrast to a sterile and demystified naturalism), romantic science emerged as an alternative to elite disciplines. A lasting legacy of these trends can be seen in the emergence of "a people's science," which embodied a "new commitment to explain, to educate, to communicate to a general public."[31] Arguably, in spite of the professionalization of the sciences, which created a perceived "gulf" between specialists and the broader public, "a people's science," as well as a romantic science flourished well into the twentieth century and beyond. This flourishing can be seen most directly in two key areas: natural history and popular astronomy (which included space exploration).

By following the life and career of Willy Ley, this dissertation supports these claims while attempting to interrogate and undermine notions of disenchantment. In many ways, Ley's works embodied a Janus-faced modernity, with its many complexities and competing representations. Ley also represented a type of romantic scientist, who celebrated wonder, awe, and the technological sublime. He exemplified the three features of romantic science, as outlined by Holmes: "the sense of individual wonder, the power of hope, and the vivid but *questing* belief in a future for the globe."[32] Simultaneously, he voiced modernist faiths surrounding science and technology, while he relentlessly debunked "pseudoscience" and "mystical thinking." He waged both a

[30] Holmes, *The Age of Wonder*, xviii.
[31] Ibid., xix.
[32] Ibid., 469.

war for enchantment and a war for disillusionment. He reconciled these extremes by promoting a modern, scientific form of enchantment, while dismissing a (perceived) medieval, superstitious form of enchantment. In some ways, this campaign connected well with more traditional romantic notions that emphasized "creative becoming, development, and self-realization," as opposed to cultist deference to tradition or authority.[33]

Additionally, Willy Ley's books and articles reveal much about modern popular science, whether in the context of Weimar Germany or postwar United States. These are understudied areas, especially when compared to scholarship on Great Britain. British historiography (particularly on the nineteenth century) has charted new territory by expanding its focus from scientific elites who popularized "science for all" to the ways in which science circulated outside of institutions, isolated journals, and laboratories.[34] Consequently, we have a far more complex survey of the cast of characters, the variety of media, the many sites of communication, and the role of the public in Great Britain during the nineteenth and early twentieth centuries.

A trend in this historiography is fascinating. As historians quickly moved from the study of elite popularizers to the sites of exchange and circulation, they began to notice popularizers who did not neatly fit into the category of professional scientists.

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[33] Robert J. Richards, *The Romantic Conception of Life: Science and Philosophy in the Age of Goethe* (Chicago: University of Chicago Press, 2002) 200.

[34] British historiography is too numerous to fully list here. For classic examples, see volume 32 (1994) of *History of Science*, which includes: Roger Cooter and Stephen Pumfrey, "Separate Spheres and Public Places: Reflections on the History of Science Popularization and Science in Popular Culture," and Anne Secord, "Science in the Pub: Artisan Botanists in Early Nineteenth-Century Lancashire." For more recent and quite ground-breaking works, see James Secord, *Victorian Sensation: The Extraordinary Publication, Reception, and Secret Authorship of Vestiges of the Natural History of Creation* (Chicago: University of Chicago Press, 2000); Aileen Fyfe and Bernard Lightman, eds., *Science in the Marketplace: Nineteenth-Century Sites and Experiences* (Chicago: University of Chicago Press, 2007); David Clifford et al., *Repositioning Victorian Science: Shifting Centres in Nineteenth-Century Scientific Thinking* (London: Anthem, 2006); Ralph O'Connor, *The Earth on Show: Fossils and the Poetics of Popular Science, 1802-1856* (Cambridge: Cambridge University Press, 2004).

For example, in a classic contribution in *Victorian Science in Context*, Bernard Lightman noted, "As science became professionalized during the Victorian period and professional science began to pursue highly specialized research, the need arose for nonprofessionals, who could convey the broader significance of many new discoveries to a rapidly growing Victorian reading public…".[35] Not only have scholars appreciated the intermediaries who occupied a public space between scientific elites and ordinary citizens, but also they have appreciated how popular culture could "actively produce its own indigenous science, or can transform the products of elite culture in the process of appropriating them…"[36] Lightman's more recent *Victorian Popularizers of Science: Designing Nature for New Audiences* describes a large cast of characters, whose "specialization" was communication.[37] Rather than continuing to focus on "legitimate" scientists, while moving from the scientific core to the periphery, scholars have begun to widen the net to appreciate a broader variety of individuals and occupations, from female naturalists to journalists.[38] Other scholars, particularly Peter Bowler, have begun to move into the twentieth century, which inevitably challenges certain reigning assumptions that have been put forth. For example, Peter Bowler's *Science for All: The Popularizers of Science in Early Twentieth-Century Britain* challenges the assumption regarding an increasing "reluctance to engage" following entrenched professionalization.[39] This challenge may invite many historians to revise their

[35] Bernard Lightman, "'The Voices of Nature': Popularizing Victorian Science," in *Victorian Science in Context*, 187-188.
[36] Ibid., 189.
[37] Bernard Lightman, *Victorian Popularizers of Science: Designing Nature for New Audiences* (Chicago: University of Chicago Press, 2007).
[38] See, for example, Anne B. Shteir, *Cultivating Women, Cultivating Science: Flora's Daughters and Botany in England, 1760 to 1860* (Baltimore: John Hopkins University Press, 1996).
[39] Peter Bowler, *Science for All: The Popularization of Science in Early Twentieth-Century Britain* (Chicago and London: University of Chicago Press, 2009).

narratives, in terms of a rise and fall of public intellectuals during the nineteenth century. It may also lead to further revisions about the alleged demise of natural history in the late nineteenth century.[40]

In other national contexts, some progress has been made. In Germany, the work of Andreas Daum has greatly enriched our understanding of nineteenth-century popular science, despite the desperate need for an English translation of his *Wissenshaftspopularisierung im 19 Jahrhundert*.[41] As a survey of the influential popular science writers, as well as the clubs, organizations, and publications, the book lays the groundwork for future studies. Additionally, scholars still find rich material in classic works, such as Alfred Kelly's *The Descent of Darwin: The Popularization of Darwinism in Germany, 1860-1914*, as well as several works on popular eugenics and what could be called "popular technology" in the German context.[42] Scholars are also heavily indebted Lynn K. Nyart's recent book, *Modern Nature: The Rise of the Biological Perspective in Germany*, which, in part, takes readers into the zoos, classrooms, and natural history museums of nineteenth-century Germany.[43]

When compared to British and even German historiography on popular science, American historiography has struggled to develop. The field has also struggled to shed

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[40] Foremost, it is hoped that this dissertation lends further support for the claims within John Gatta's *Making Nature Sacred: Literature, Religion, and the Environment in America from the Puritans to the Present* (Oxford: Oxford Scholarship Online, 2004). Gatta argued, "Incredibly, belief in the more-than-material 'strangeness' of material nature has somehow managed to survive this country's transformation by industrialization, the demise of noncommercial agrarianism, the intellectual triumph of empirical science, and the latter-day emergence of a post-industrial consumer society wedded to technology." See Gatta, *Making Nature Sacred*, 2.

[41] Andreas *Daum, Wissenschaftspopularisierung im 19. Jahrhundert: Bürgerliche Kultur, naturwissenschaftliche Bildung und die deutsche Offentlichkeit, 1848-1914* (Munich: Oldenbourg, 2002).

[42] For an intellectual history that is quite relevant, see also, Anne Harrington, *Reenchanted Science: Holism in German Culture from Wilhelm II to Hitler* (Princeton: Princeton University Press, 1996).

[43] Lynn K. Nyart, *Modern Nature: The Rise of the Biological Perspective in Germany* (Chicago and London: The University of Chicago Press, 2009). See also, John Alexander Williams, *Turning to Nature in Germany: Hiking, Nudism, and Conservation, 1900-1940* (Stanford, California: Stanford University Press, 2007).

its diffusionist baggage. Most notably, John C. Burnham set the tone in *How Superstition Won and Science Lost: Popularizing Science and Health in the United States* (1987).[44] In his view, the popularizers first emerged in the nineteenth century "to diffuse knowledge," yet it was a losing battle, particularly when the "triumph of superstition was also signaled by the retreat of broad, well-educated missionaries of science from the field of popularization and their replacement by those who were influenced by the mass media, or actually worked in journalism, public relations, and advertising."[45] Accordingly, twentieth-century popular science "changed from a coherent view of nature… into choppy, unconnected 'facts.'"[46] Without the trained guidance of elite practitioners, the public received "superstition… sensationalism and disjointed facts… [and] magical thinking."[47] It is a tale of "warfare between science and the forces of obscurantism, [in which] religion and superstition became confusingly entangled on the same side, setting the stage for advertising to co-opt this entire complex in the age of mass media."[48] In the end, Burnham argues, "science probably did not exist any longer on the popular level. Superstition did."[49]

More recently, scholar Marcel Chotkowski LaFollette has enriched our cast of characters surrounding popular science in the United States.[50] Her surveys of science on radio and television are particularly useful. This research has, in many ways, served as a

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[44] John C. Burnham, *How Superstition Won and Science Lost: Popularizing Science and Health in the United States* (New Brunswick and London: Rutgers University Press, 1987).
[45] Ibid., 4.
[46] Ibid., 5.
[47] Ibid., 7.
[48] Ibid., 13.
[49] Ibid., 262.
[50] Marcel Chotkowski LaFollette, *Science on American Television: A History* (Chicago and London: University of Chicago Press, 2013; *Making Science Our Own: Public Images of Science, 1910-1955* (Chicago: University of Chicago Press, 1990); *Science on the Air: Popularizers and Personalities on Radio and Early Television* (London and Chicago: University of Chicago Press, 2008).

crucial first step for scholars. Nevertheless, it is striking how the tone of her work can complement Burnham's earlier perspective. In *Science on the Air*, LaFollette described the ambitions of scientists in these terms: "From the 1920s to the 1940s, the scientific community became more concerned about scripting its public image for the sake of increased funding and political support, and therefore became more engaged in popularization." Thus, their motivations were self-serving, institutional, and professional. LaFollette also argued that the "way in which most people learned about science outside schoolrooms and textbooks—that is, through mass communications media—became increasingly shaped by entertainment values. In the competitive world of commercial broadcasting, science was dramatized, personalized, and eventually marginalized."[51] She continued, "By the mid-1930s the networks were increasingly pressuring popularizers to emphasize scientific personalities over facts and excitement over education." At the same time, "Although a few successful, accomplished scientists did become involved in radio (and eventually in early television) for reasons linked to ambition, money, and idealism, the scientific community as a whole remained uneasy and suspicious of the mass media." LaFollette presented a similar case in *Science on American Television*, in which she stated: "Television's unbending obeisance to audience size as the best measure of quality meant that producers fell (or were pushed) into the trap of choosing to entertain than educate…"[52] She continued, "And, in the end, the unwillingness of professionals, within both television and science to compromise in order to serve the audience continually undermined the process of creating the best

[51] Marcel Chotkowski LaFollette, *Science on the Air*, prologue.
[52] LaFollette, *Science on American Television*, 215. For a relevant discussion of popular science on film and television, see Allan Jones, "Mary Adams and the Producer's Role in Early BBC Science Broadcasts," as well as Grace Reid, "The Television Drama-Documentary (Dramadoc) as a Form of Science Communication" in *Public Understanding of Science* 21 (2012): 984-1001; 1002-1018.

possible programs and discouraged future popularization ventures."[53] Both scientists and television producers "lost sight of what viewers needed and deserved."[54]

In this perspective, television and radio were similar stories. Just as radio had dramatized, personalized, and marginalized science, television "slowly squeezed theories, processes, explanations, and conclusions into sound bites and accentuated the social problems, moral dilemmas, ethical challenges, and controversies related to science."[55] Entertainment won. Science lost. In *Science on the Air*, LaFollete also stated the broader agenda behind her historical endeavors. The text reads:

> If we value a scientifically literate society, if we want people to reject tomfoolery disguised as science, to ask reasonable questions about research parameters, and to understand why knowing more about science will help them make wiser consumer, medical, economic, and political decisions, then we must consider how they learn about science once they leave formal education behind. How will information about science reach general audiences in the future? Who will take the responsibility for delivering science to the public?

In other words: Who will carry the torch of dissemination and enlightenment?[56] This task is too important to be left in the hands of profit-oriented media producers.

Both Burnham and LaFollette share a common perspective, which focuses on the "legitimate" scientists who struggled to communicate science in the realm of mass media.[57] In both works, there is an explicit dichotomy between scientists and cultural producers. The scientists either reluctantly "cooperated" or vainly argued against popular superstitions, in various media where superstition and sensationalism sold.

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[53] Ibid.
[54] Ibid.
[55] Ibid., 6.
[56] This present-oriented question has motivated much scholarship, particularly in Great Britain.
[57] This perspective still plagues more recent studies of the "public understanding of science." Although scholars continue to reject simple model of diffusion, there is still a dominant focus of the scientists who engage and the public relations efforts of institutions. Even attempts to understand the role of style in scientific communication rarely discusses the impact and influence of science writers like Ley, Asimov, and Sagan. See, for example, Massimiano Bucchi, "Style in Science Communication," *Public Understanding of Science* 22: 904-915.

They offered truth to an audience craving awe and wonder. They struggled to entertain without sacrificing the dignity and truth of their science. Often, it was a losing battle. Neither of these accounts attempts to understand the "indigenous science" that flourished within American popular culture. Instead, they move from the core of a scientific community to the periphery of the public, attempting to understand why diffusion can fail. Popular science, in the end, turns out to be compromised science, anti-science, or pseudoscience. It had been transformed from a pure state to a vulgarized titillation.

This dissertation adopts a different perspective. Although it focuses on an intellectual and his attempts to educate a broader public, it presents a nuanced account of the rise of scientific journalism and the media-savvy scientific "generalist." It situates Ley within a network of scientific thinkers and intellectuals who embraced mass media and public education.[58] They did not retreat in the face of superstition or sensationalism. They engaged with the public, while they contrasted themselves to isolated and ineffective scientific specialists. For the most part, they did not consider themselves as "experts," simply disseminating the truth to passive audiences. Instead, they promoted a type of "romantic science" and a type of "scientific thinking" that democratized science for all. They considered themselves as "generalists," who could make sense of the competing sub-disciplines of the scientific establishment. They understood the connections, the commonalities, and the "whole" in a way that was catered not only for public consumption but also to public participation through forums, clubs, lectures,

[58] This perspective will be related directly to the recent works of Andrew Jewett and John L. Rudolph. See Andrew Jewett, *Science, Democracy, and the American University: From the Civil War to the Cold War* (Cambridge: Cambridge University Press, 2013); John L. Rudolph, *Scientists in the Classroom: The Cold War Reconstruction of American Science Education* (New York: Palgrave, 2002).

newspapers, magazines, books, and broadcasts. They contrasted popular science (as both a genre and an activity) with professional science. The specialists were seen as lost in isolation. The generalists, conversely, produced, whether they served as scientific consultants to film or wrote popular books and articles.

Therefore, this is not a story of science versus media.[59] It is a story of scientific media that flourished, particularly in New York City during the 1930s, 1940s, and 1950s.[60] It makes the case that we cannot understand American popular science by moving outward from a scientific elite (and their "pure" science) to a "periphery" of an audience (and their 'vulgarized' 'sound bites'). Instead, we have to begin with the intermediaries, such as the science writers who communicated and celebrated wonder, awe, and mystery.[61] If historians recognize that popular science had a life of its own, often separate from realm of practicing scientists, then it becomes rather silly to ask: "Does popularized science have to be composed by scientists?"[62] It is crucial for historians to recognize that "popular science publishing happens within the wider cultural and political context…"[63] Our cast of historical characters must be diverse and

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[59] In recent years, the alleged dichotomy between science and media has continued to break down. See, for example, Dominique Brossard, "Media, Scientific Journals and Science Communication: Examining the Construction of Scientific Controversies," *Public Understanding of Science* 18 (2009): 258-274. Brossard argues, "…mass media's role in science communication cannot be studied in isolation, and… scientific journals and mass media work in interaction in the construction of scientific controversies."

[60] It is hoped that this account will invite scholars to view the "boom" of popular science writing in the 1970s in terms of continuity. Instead of seeing Carl Sagan, Stephen Hawking, and other writers as inaugurating a blossoming genre, scholars will view the writers in terms of a longer tradition.

[61] In many ways, other scholars have embarked upon similar endeavors. See, for example, James Gilbert, *Redeeming Culture: American Religion in an Age of Science* (Chicago and London: The University of Chicago Press, 1997).

[62] This question is asked quite frequently. See, for example, Alice R. Bell and Hauke Riesch, "Researching Popular Science: More Diverse than the Limitations of Apparent Publishing 'Booms,'" *Public Understanding of Science* 22 (2013): 517.

[63] Efforts to understand "public engagement" have been hindered by an approach that moves from a core of researchers out to a periphery of media audiences. These models often disregard the intermediaries in favor of the "legitimate" scientists or committees who chose to engage. For an interesting historiographical survey of this literature, see Martin W. Bauer and Pablo Jensen, "The Mobilization of Scientists for Public Engagement," *Public Understanding of Science* 20 (2011): 3-11. See also, W. E.

inclusive.[64] It must include a wide range of actors, from publishers to television producers.[65] If we widen our historical net, then it quickly becomes obvious that the "history of science is more than the history of scientists: it is also the history of what 'science' and 'nature' mean to each one of us."[66] The science writers promoted and represented "a community of scientific imagination that is larger and more diverse and that carries within it a wider body of experience than it has been traditional to consider…"[67] They were publicly-recognized spokespeople for science, who operated independently.

The science writers were not simply translators, simplifiers, or (some would say) vulgarizers. Their skills as generalists were far more valuable than a specialist's expertise. Their ability to communicate set them apart. They also fearlessly blended genres, combining science with art, poetry, and imaginative fiction. In a related project, they contrasted "a people's science" with an inaccessible and aristocratic scientific hierarchy that operated through exclusion.[68] The modern romantics and other public intellectuals celebrated the links between American democracy and amateur science, in which everyone could participate by learning science while enjoying the enchantment.

Bijker, R. Bal, and R. Hendriks, eds., *The Paradox of Scientific Advice in Democracies* (Cambridge: The MIT Press, 2009).

[64] This broadening inclusiveness has been an increasingly important trend in the historiography of science communication. In particular, see Bruce Lewenstein, "Science and the Media," in *Handbook of Science and Technology Studies*, eds. S. Jasanoff, G.E. Markle, J.C. Peterson, and T. Pinch (Thousand Oaks, CA: Sage, 1995): 343-360. See also, Massimiano Bucchi and Brian Trench, eds., *Handbook of Public Communication of Science and Technology* (London and New York: Routledge, 2008).

[65] As scholars like Topham have noted, the historiography of popular science owes a large debt to the media scholarship of Roger Chartier and Robert Darnton.

[66] Katherine Pandora and Karen A. Rader, "Science in the Everyday World: Why Perspectives from the History of Science Matter," *Isis* 99 (2008): 350.

[67] Ibid., 353.

[68] This dissertation does not seek to revive older distinctions between the "professional" and the "popular." Indeed, scholars have made much progress in breaking down a traditional distinction that privileged diffusion between two camps. Nevertheless, this dissertation argues that we can identify distinctive elements of a "profession" of science education that could be far removed from research sites and academic institutions.

They intentionally blurred the distinctions between science communication, public engagement, and scientific thinking. Thus, the boundaries between the museum and the theater became increasingly blurred, as the public was encouraged to witness and experience the wonders of nature and the marvels of science. Sometimes, these popular intellectuals could argue that ordinary Americans were capable of understanding science as a whole, in contrast to elites. Thus, the science writers often celebrated "a separate form of scientific knowledge within popular culture which is not necessarily a reflection of professional science, and may even oppose the latter."[69] They embodied science in the vernacular. They sustained a long tradition of giving "the public a sense that they participated in the production of knowledge."[70] Like Victorian predecessors, they provided "syntheses, synoptic overviews and more: at heart, as storytellers who engaged with questions of meaning, as well as providing information, they brought the larger public into communication with the search for natural knowledge by incorporating their hopes and dreams and fears and speaking directly to their experiences."[71]

Conversely, those elites had long retreated into a discourse of "disenchantment." Quoting Michael Saler: "They did this as a way to maintain distinctions between themselves and the masses in the seventeenth and eighteenth centuries, to secure the

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[69] Elizabeth Leane, *Reading Popular Physics: Disciplinary Skirmishes and Textual Strategies* (Burlington, VT: Ashgate, 2007), 9. Scholars have often noted how the "playing field" was leveled in favor of professional scientists. As summarized by Jonathan Topham: "…the science of the people is ineluctably enmeshed – through domination, resistance, and appropriation – with the science of the dominant culture, often as encountered through science popularization." See Topham, "Rethinking the History of Science Popularization/Popular Science" in *Popularizing Science and Technology in the European Periphery, 1800-2000*, eds. Faidra Papanelopoulou, Agusti Nieto-Galan, and Enrique Perdiguero (Burlington, VT: Ashgate, 2009), 3-4.

[70] See Lightman, "'The Voices of Nature': Popularizing Victorian Science," in *Victorian Science in Context*, chapter 9.

[71] Pandora and Rader, "Science in the Everyday World," 357.

prominence of 'normal science' against both religion and alternative forms of knowledge… and to retain their cultural authority against the challenges posed to it by the new mass culture…"[72] If historians seek to understand popular science (and the popular history of science) on its own terms, then they will recognize the continuity of enchantment, as well as the attempts by elites to demarcate non-elites and police the boundaries of knowledge and expertise. These efforts to produce and protect a "pure" science or a "sophisticated" enjoyment of the arts can be seen as reactions to mass culture, which could operate independently of elite discourse. As such, American popular science had a life of its own. To adopt a perspective of the diffusion of knowledge from an educated elite to a mass audience is to fundamentally misrepresent the situation. Rather, historians need to see American popular science on its own terms, as it flourished and circulated in "informal environments."[73] As scholars have continued to discredit a "one-dimensional" or "diffusionist" model of science communication, they have made much progress in documenting "a large ensemble of appropriations and re-creations of science, with different motives and realized in different medias."[74]

Granted, American popular science and various discourses of enchantment can also be seen as reactions to elite strategies of disenchantment. Here, it is quite important to contextualize popular science within long traditions of American anti-authoritarianism in popular culture. As seen in Susan Scott Parrish's *American*

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[72] Saler, "Modernity and Enchantment," 693.
[73] In a recent committee study, Philip Bell, Bruce Lewenstein, Andrew W. Shouse, and Michael A. Feder conclude that, in spite of decades of research in the public understanding of science, we still know very little about the learning of science outside of educational institutions. As will be shown, a focus on Willy Ley will shed much light on science education as it flourished informally in mass media. See Philip Bell, Bruce Lewenstein, Andrew W. Shouse, and Michael A. Feder, eds., *Learning Science in Informal Environments: People, Places, and Pursuits* (Washington, DC: The National Academies Press, 2009).
[74] Jon Turney, "Popular Science Books," in *Handbook of Public Communication of Science and Technology*, 6.

Curiosities: Cultures of Natural History in the Colonial British Atlantic World, many Americans resisted or resented hierarchies of knowledge.[75] Instead, republicanism demanded participatory engagement, along with a democratization of knowledge, skills, and arts. Media scholars have long noted this characteristic of American popular culture. Most famously, Lawrence Levine's classic *Highbrow/Lowbrow* explored the egalitarian, rowdy, and volatile world of nineteenth-century theater. More recently, Richard Butsch's *The Citizen Audience: Crowds, Publics, and Individuals* explored how the very idea of citizenry found its most poignant expression in public participation at spectator events, such as theaters. American identity could be expressed in strongly anti-authoritarian terms that inherently distrusted elite expertise. Americans preferred showmen, like P.T. Barnum or Buffalo Bill. They also preferred intelligible generalists.

Thus any analysis of popular science or science in media cannot begin with an analysis of an elite scientific discipline and the "legitimate" scientists who cautiously approached a microphone. We also cannot simply focus on the "prestigious researchers" who reluctantly "cooperated" within a medium they considered "intrinsically sensationalistic…"[76] Such a perspective would privilege a dry, uninspiring, and possibly inaccessible radio lecture or a panel of four scientists casually discussing the implications of atomic physics. As historian Katherine Pandora noted in a focus section of *Isis*: "To explore the nature of scientific meaning in the popular sphere… requires more than a knowledge of what a learned elite was doing: a more competent fluency and more complete knowledge of cultural practices of an era and a locale are needed as

[75] Susan Scott Parrish, *American Curiosities: Cultures of Natural History in the Colonial British Atlantic World* (Chapel Hill: University of North Carolina Press, 2006).
[76] Lafollette, *Science on the Air*, chapter 1.

well."[77] Pandora further suggested, "Staying too closely tethered to historiographies of disciplinary and subdisciplinary professional activity makes such forays difficult to achieve." In the case of the science writers and other scientific intellectuals, such a tether would be a fatal obstacle. Their works of popular science circulated in the marketplace, while they navigated the publishing and media networks of New York City. Many, like Ley and L. Sprague de Camp, worked as freelance writers without institutional ties. They flourished in an open, cosmopolitan environment in which communication skills mattered far more than a university degree or a research fellowship.

This dissertation attempts to take readers into their world by focusing on one of the most prolific science writers of the mid-twentieth century. By following the life and career of Willy Ley, we can gain a better understanding the motivations of a freelance writer who spent his life exciting the public about the wonders of science and technology. Much of his writing focused on "the conquest of space." These activities made Ley famous as a "rocket expert." This identity is an important part of the story. Arguably, Ley's space-related media illustrated how the "Space Age," as it flourished in American popular culture, blended genres, while offering an uplifting and romantic vision of science, technology, and the "ascent of man." Simply put, we can see much continuity between the motifs and tactics of spaceflight advocates and earlier generations of scientific educators who attempted to excite the public about the wonders of science and technology.

[77] Katherine Pandora, "Popular Science in National and Transnational Perspective: Suggestions from the American Context," *Isis* 100 (2009): 351.

The "Space Age" can be viewed as an exemplary moment of modern enchantment. Like Saler's "virtual worlds," the "Space Age" offered Americans a playful, yet somewhat restrained way to reconcile certain extremes.[78] It also provided key moments of "virtual witnessing." As scholars have extended this term from its original and somewhat limited use in Shapin and Schaffer's groundbreaking *Leviathan and the Air Pump* (1985), they have increasingly recognized how the "technology" of a literary reenactment of an experiment began to flourish outside of the original boundaries of supervision and regulation by a group of elite scientists. Scholar David A. Kirby explains: "The validation of scientific facts no longer rested only in the hands of investigators; access to scientific demonstrations allowed the public to verify knowledge for themselves."[79] The mediated reality of the "Space Age" included many forms of virtual witnessing, collective imagining, and experiential fantasizing. Quite often, Ley had a very direct or indirect influence on those experiences. Metaphorically speaking, he was the one of the men behind the curtain, pulling levers and adjusting lights.

Understanding Ley's role in the "Space Age" is also important, because it helps to shift the focus away from institutional histories, as well as biographies that focus on scientists and engineers. Ley's role in the history of spaceflight demonstrates the importance of thinking about the circulation of texts and the role of individuals who operated outside of scientific laboratories and machine shops. One could even argue that Ley is an exemplary figure who recognized that "science is a form of

[78] This argument will be related to Marina Benjamin's *Rocket Dream: How the Space Age Shaped Our Vision of a World Beyond* (New York: Free Press, 2003)
[79] David A. Kirby, *Lab Coats in Hollywood: Science, Scientists, and Cinema* (Cambridge: MIT Press, 2010). Kirby also credits David Gooding's emphasis on Michael Faraday's use of public theater.

communicative action," by which "knowledge in transit" puts the popular science writer at the center of the "project of science."[80] Considering that Ley did so much to inspire Americans to support a publicly funded "conquest of space," the scientific and technological accomplishments of the era were, in some ways, consequential of media. The history of science and technology can reframed as a history of communication.

Crudely put, Willy Ley was the most important publicist of the "Space Age." He shared the stage with Wernher von Braun, who has been called "the single most important promoter of America's space effort in the 1950s and 1960s."[81] This dissertation does not seek to challenge von Braun's importance both as a historical actor and a historical subject. Yet, it does invite historians to consider how works of the "Huntsville School" inflated von Braun's importance, while groundbreaking challenges to that camp of historians has kept a focus on von Braun. It is hoped that this dissertation will cause readers to feel bewildered by both the cottage industry of books on engineers and astronauts and the lack of a single biography of the movement's publicist.

In recent decades, many scholars have embraced a cultural turn in history that has moved away from institutional narratives that tell an insider's story or a social history of an organization. Although a cottage industry of popular books on Apollo still dominates the marketplace, the history of spaceflight has become far more academic and insightful. It also takes historians further away from the traditional boundaries of

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[80] See James A. Secord, "Knowledge in Transit," *Isis* 95 (2004): 654-672.

[81] Roger D. Launius, "The Historical Dimension of Space Exploration: Reflections and Possibilities," *Space Policy* 16 (2000): 25. The rich scholarship on Wernher von Braun serves as an important guide to this dissertation. Most notably, the works of Michael J. Neufeld have been instrumental in shaping the perspective on the V-2 rocket and the postwar scene. See Michael J. Neufeld, *The Rocket and the Reich: Peenemünde and the Coming of the Ballistic Missile Era* (Cambridge: Harvard University Press, 1995); *Von Braun: Dream of Space, Engineer of War* (New York: Vintage Books, 2007).

space history, which, in the words of Asif Siddiqi, "have typically examined the history from the top looking down, describing only the tallest of trees of a vast forest of society and culture."[82]

A focus on Ley is particularly useful for historians of spaceflight. If there was a "founding father" of this historical field, it was Ley, whose *Rockets, Missiles, and Space Travel* went through 21 printings from 1944-1969. Michael J. Neufeld is correct to argue: "Ley… more than anyone else founded space history in the English-speaking world."[83] His *Rockets* also circulated widely. Roger D. Launius labeled the book as "one of the most significant textbooks available in the mid-twentieth century on the possibility of space travel."[84] While it is true that the book educated American audiences about rockets and space travel, it also served as the first historical grand narrative. To a large extent, Ley's memoir and even his personal perceptions of key individuals have deeply influenced secondary literature on the history of spaceflight. As Siddiqi notes, Ley's depiction of key visionaries and their subordinate inventions privileged the role of the individual genius over the role of states or even institutions. His historical synthesis of "Prophets with Some Honor," with their corresponding "steps" in the right direction had a lasting impact on the field. Siddiqi rightly notes: "So powerful was this synthesis that to this day, almost all history books on space

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[82] Asif S. Siddiqi, "American Space History: Legacies, Questions, and Opportunities for Future Research," in *Critical Issues in the History of Spaceflight*, eds. Stephen J. Dick and Roger D. Launius (Washington, DC: National Aeronautics and Space Administration, History Division, 2006), 434. The perspective of Siddiqi has served as important guide. See Asif Siddiqi, *The Red Rockets' Glare: Spaceflight and the Soviet Imagination* (Cambridge: Cambridge University Press, 2010). See also: *Into the Cosmos: Space Exploration and Soviet Culture*, eds. James T. Andrews and Asif A. Siddiqi (Pittsburgh: University of Pittsburgh Press, 2011).

[83] Michael J. Neufeld, "Creating a Memory of the German Rocket Program for the Cold War," in *Remembering the Space Age: Proceedings of the 50th Anniversary Conference*, ed. Steven J. Dick (Washington, DC: National Aeronautics and Space Administration, 2008), 71.

[84] Roger D. Launius, *Frontiers of Space Exploration* (Westport, CT: Greenwood Press, 1998), 190.

exploration begin by invoking Tsiolkovsky, Oberth, and Goddard—and then move to von Braun's team."[85]

Although Ley presented his narrative in international terms, he simultaneously privileged the role of the German "pioneers" at every turn. Historians have often struggled against the power of his narrative to establish a place for indigenous American accomplishments. One could read the initial turn toward institutional histories or biographies of astronauts as a struggle to counter-balance Ley's German-centric accounts. Yet, even when struggling against Ley's perspectives, historians have been deeply influenced by his perceptions and claims. We are in fact still untangling many of the facts from the fabrications. As demonstrated by the superb work of Neufeld, Ley's narratives contained much misinformation, due to his reliance on ex-Nazi engineers and their selective memories of the underground factories that utilized concentration camp labor to construct V-2 rockets. Thus, many historians of spaceflight have long struggled to uncover the truth behind the stories told to Ley, which he repeated for a mass audience. In other examples, Ley's own memories could be self-serving, as memoirs naturally are. For example, Ley, especially in the 1950s and 1960s, claimed to have been a founding member of the German Rocket Society (often abbreviated from German as the VfR). As will be demonstrated in chapter 2, there is little evidence to support this claim, other than Ley's memoirs. This dissertation will attempt to recognize and untangle the power of Ley's narratives on the field of space history. Other aspects of this biographical narrative will highlight the instances in which Ley was a divisive and controversial figure, particularly among other spaceflight advocates like G. Edward Pendray of the American Rocket Society. Pendray and Ley's feud over the legacies of

[85] Siddiqi, "American Space History," 436.

"founding fathers" reveals an important aspect of space history that influenced the field for decades. Arguably, the tensions of that feud are still alive today, as seen in competing representations and claims within museums and secondary literature.

In spite of this necessary focus on rockets and space travel, this dissertation argues that Ley's roles as a spaceflight advocate and historian were a smaller parts of a broader crusade to educate the public, conflate science and imagination, promote a romantic appreciation of nature, and glorify the technological sublime. In fact, the key to understanding his many works on spaceflight is to appreciate the blending of genres and the overlapping interests that united his fascination with rockets with his fascination with the Dodo Bird. In this sense, it is extremely important to explore his many "adventures" as a "romantic naturalist." The conquest of space related to the broader conquest of nature. It was the culmination of a long history of exploration, wonder, and discovery. Ley is a prime example of a popular science writer who continued in a long and transnational tradition of exploring the wonders of the world. In many ways, he united natural history and popular astronomy together in a literature for mass consumption. He encouraged a romance with nature. The way in which historians describe the tropes of spaceflight literature can be applied to all of Ley's works, in which "reason was combined with a modern form of manifest destiny…"[86] Ley championed "a marriage of the near-spiritual urge to explore new frontiers…"[87]

[86] Ibid., 436. Here, Siddiqi is characterizing the thoughts of early historians, who were deeply influenced by Ley's accounts.
[87] Ibid.

So many historians have viewed these tropes in terms of American identity and the equation of space with the Western frontier.[88] Other scholars have focused on the darker implications of a modernist mentality that celebrated the conquest of nature and worshipped the brave engineer. For example, in *Astrofuturism: Science, Race, and Visions of Utopia in Space*, De Witt Douglas Kilgore critiques the "public apologists for the value of science," along with their technological notions of progress.[89] For Kilgore, Ley is a perfect example of a futuristic thinker who blended manifest destiny, teleological arguments, and faith in the power of technoscience. With little awareness of the destructive consequences, Ley advocated for the complete conquest of nature, the exploitation of "her" resources, and the violent redesign of landscapes for the benefit of "man." He also sought to debunk "nonsense," propaganda, mystical thinking, and "pseudoscience."

Ley was a modernist, and his broader crusade as a public educator also had a more forceful side. Here, this dissertation relates Ley to other public intellectuals, writers, and historians with less self-consciously romantic ideals and aspirations. This group shared a commitment to public engagement, along with a desire to write for popular audiences.[90] From scientific historians like George Sarton to science writers like Isaac Asimov, these scientific intellectuals strove to dispel "nonsense," discredit

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[88] See, for example, Roger D. Launius, "The Historical Dimension of Space Exploration: Reflections and Possibilities," *Space Policy* 16 (2000): 23-38.

[89] De Witt Douglas Kilgore, *Astrofuturism: Science, Race, and Visions of Utopia in Space* (Philadelphia: University of Pennsylvania Press, 2003),

[90] Unlike many later educators of the 1980s and 1990s, the science writers, for the most part, did not have a negative view of the "public" as ignorant, hostile, or anti-scientific. Also, they did not think of their roles simply in terms of diffusion and a public "deficit" of knowledge. In fact, it is quite striking how many science writers privileged the role of public engagement, particularly when it came to amateur science, the role of virtual witnessing, and mass participation. For an interesting summary of debates about diffusionist language and the rhetoric of public engagement, see Jack Stilgoe and Simon J. Lock, "Why Should We Promote Public Engagement with Science?" *Public Understanding of Science* 23: 4-15. It is hoped that this dissertation demonstrates how popular writers actively engaged with questions that only recently attracted much scholarly attention.

"pseudoscience," and purge "irrationalism" from the ranks of the popular. After all, they were modernists, who prescribed a mode of "scientific thinking" as an antidote to superstition and mystical thinking. They also engaged in a related political struggle, as they equated both fascism and communism with a generalized totalitarianism that explicitly promoted deference to authority, the mystic submission to a medieval "truth," and cult-like obedience to a pre-modern mindset.[91]

Their view of the world was stark, given the context of the Second World War and the ensuing Cold War. In one corner stood American democracy and science, both of which promoted freethinking and the open search for truth.[92] Both democracy and science encouraged a critical anti-authoritarianism and a republican ethos. Not coincidentally, this camp of scientific intellectuals adopted and strengthened certain Whiggish histories, which celebrated the champions of science as revolutionary and sometimes tragic figures who spoke truth to power in an attempt to enlighten the people. The modern scientist, they argued, had the same social responsibility to save souls from the spread of totalitarianism by preaching the "scientific spirit," with its instinctive disregard for dogma. In the other corner stood totalitarianism, spreading as a powerful menace to threaten all political and scientific progress by eliminating freedom of thought, along with scientist's ability to speak truth to power. Totalitarian science, in this view, was by nature pseudoscience, since it functioned by cult-like adherence to

[91] This perspective builds most directly from the work of Americanist Benjamin Alpers. See, Benjamin L. Alpers, *Dictators, Democracy, and American Public Culture: Envisioning the Totalitarian Enemy, 1920s-1950s* (Chapel Hill and London: The University of North Carolina Press, 2003).

[92] Several scholars have served as useful guides to understanding representations of science during the Second World War and the Cold War. Most notably, this dissertation is heavily influenced by the work of David A. Hollinger. See David A. Hollinger, "Science as a Weapon in Kulturkämpfe in the United States During and After World War II," *Isis* 86 (September, 1995): 440-454; *Science, Jews, and Secular Culture: Studies in Mid-Twentieth Century American Intellectual History* (Princeton: Princeton University Press, 1996).

state-directed truths. The authoritarian mind could not tolerate dissent, the engine of "real" science.

Although many of the individuals who voiced these beliefs should not be labeled as "romantics," there was a mystical and even religious component to their conceptions of Western science as a universal language that transcended nationalism, parochialism, and "backwardness." As will be clear from many quotes, they often invoked religious language, while speaking about their "faith" in science and humanity. For example, one sociologist asked if science could ultimately save humanity. He answered, ""When we give our undivided faith to science, we shall possess a faith more worthy of allegiance than many we vainly have followed in the past, and we shall also accelerate the translation of our faith into actuality."[93] This view of science could be labeled as deeply mystical and enchanted. Even as these intellectuals participated in the various pseudoscience wars that flourished in mass media, they did not promote a completely disenchanted science, void of transcendental qualities. Understanding how a twentieth century positivist could both rally against metaphysics and yet express faith in science will lead us to the heart of a Janus-faced modernity. Hopefully, it will make the label of "scientism" seem inadequate as a description of a complex and contradictory set of beliefs.

Chapters 1 and 2 will provide essential background for many of these arguments, by focusing on Ley's formative years in Germany. These chapters will illustrate how his notions of science were greatly influenced by popular romanticism and science fiction. They will also demonstrate how an embrace of amateur clubs,

[93] George A. Lundberg, *Can Science Save Us?* (New York, London, and Toronto: Longmans, Green and Co., 1947), 115.

popular media, and the intermediaries who could translate complex concepts for a general audience defined Ley's entrance into the world of science. Chapter 2, in particular, illustrates how Ley's emerging identity as a freelance writer was constructed in reaction to several perceived "others": the isolated and ineffective scientist and the effective, but dangerous pseudoscientist. Chapter 3 will focus on his perceptions of the decline of amateur groups and science, due to the rise of totalitarianism and "anti-science" in the early 1930s. This chapter argues that his notion of what constituted "real" science was also constructed in reaction to a perceived "other": the spread of irrationalism that transformed Germany from a vibrant democracy into a totalitarian state. Chapters 4 and 5 recount Ley's early years in the United States, after he fled Nazi Germany in 1935. Whereas chapter 4 explores his early adventures as a freelance "romantic naturalist," chapter 5 documents his rise as a public educator during the Second World War. These chapters begin to put forth a more complex argument surrounding modern enchantment and popular science, in the context of war and a perceived totalitarian menace. Chapters 6 and 7 then turn to the postwar years, when Ley established himself as America's top expert on rockets, missiles, and space travel. These chapters will highlight the nexus of popular science and mass media, along with the various "crusades" to educate, entertain, and debunk. In these chapters, "modern enchantment" is situated within the somewhat contradictory "pseudoscience wars" that flourished in popular culture. Likewise, Ley is situated within a diverse camp of modernists who often expressed romantic ideals. Chapters 8 and 9 follow these trends throughout the late 1950s and most of the 1960s, when the "Space Age" exploded in popular media. These chapters illustrate Ley's overarching tactics as a popularizer of

awe, wonder, and the technological sublime. Simultaneously, they present his efforts as a popular science writer in relation to a larger camp of science writers, public educators, and even historians of science, whose actions and tactics were quite political, given the context of the Cold War. It is also hoped that these chapters will be of particular relevance to other historians of science. This project invites other historians to consider the ways in which their academic discipline emerged from a cosmopolitan, open, and socially engaged environment. In particular chapter 9 explores Ley's declining prestige as a historian of science, as both the "Space Age" and the history of science became institutionalized. As the history of science transitioned from an open and cosmopolitan endeavor into an isolated and academic field, Ley was one of many scientists-turned-historians who were excluded and ostracized. His perspectives were seen as Whiggish and self-serving. His style of popular writing quickly became old-fashioned. Arguably, there is a larger story here about the institutionalization of the history of science that may invite scholars to ask, "What was lost?"

Chapter 1: Youthful Horizons

Berlin, circa 1917. A ten-year-old boy named Willy Ley stood ready to be judged by his teacher and peers. He had been given the writing assignment of answering a question: "What Do I Want to Be When I Am Grown and Why?" The teacher was about to pass judgment on his ambitions in life.

The question was not simple for the young Berliner. It could not have been an easy question for many of his peers. Some classmates had probably lost their fathers in the ongoing Great War, which claimed (on average) the lives of 1300 Germans per day.[94] This loss of life eventually created over 350,000 widows and left over 730,000 children fatherless.[95] These students were part of a generation that, in the words of historians, "were by and large not allowed to mourn."[96] In the years to come, they would experience "the weight of the dead upon the living," as German society commemorated its lost generation, perceived to have sacrificed everything only to be betrayed by politicians.[97] A popular "cult of the dead" would mimic the children's attempts to mourn.[98] In the following years, the students who did not lose their fathers may have witnessed the familial effects of *Kriegsneurose* (war neurosis) as veterans struggled to readjust to civilian life.[99] These veterans would become both the

[94] Audoin-Rouzeau and Becker, *Understanding the Great War* (New York: Hill and Wang, 2000), 22.
[95] These figures are quoted in Richard Vinen, *A History in Fragments: Europe in the Twentieth Century* (Cambridge, MA: Da Capo, 2000), 70 and 75. For original sources for some of these figures, see Richard Bessel, *Germany After the First World War* (New York: Oxford, 1993), 275-276.
[96] Audoin-Rouzeau and Becker, *Understanding the Great War*, 9.
[97] Ibid., 1.
[98] Ibid., 36.
[99] Ibid., 25.

simultaneous heroes and victims of a war, in which "an aesthetic and ethical code of heroism, courage, and battle violence vanished…"[100]

For the meantime, these students witnessed their mothers struggling to provide sustenance for the family amidst bread and potato shortages, food riots, strikes, and a general state of war weariness.[101] Although most Berliners did not experience many of the atrocities closer to the trenches, they endured a blockade, which, some historians estimate, indirectly killed a million people during the war.[102] According to other historians, "A German who tried to live off official rations between November 1916 and May 1917 lost one-fifth of his body weight."[103] The everyday realities of wartime urban life had also, in the words of historian Belinda J. Davis, "shattered the illusion of upholding the ideal family and the role of its members."[104] Davis continued, "Life was less than ever centered among a closed circle of people within the four walls of a rented room, but was played out far more on the streets, in bread and other food lines as well as in factories."[105] Poorer women were particularly hard hit by the wartime situation, as they "stood in the streets seeking potatoes," while "faced with dread the daily task of trying to feed themselves and their families, frustrated by new measures that failed to treat the lack of access, angered by the increasingly rancorous interactions with merchants, and tired of finding and waiting endlessly in lines, resolutely defending their

[100] Ibid., 28.
[101] For an excellent account of the everyday life of Berliners during the First World War, see Belinda J. Davis, *Home Fires Burning: Food, Politics, and Everyday Life in World War I Berlin* (Chapel Hill and London: The University of North Carolina Press, 2000).
[102] Cited in Audoin-Rouzeau and Becker, *Understanding the Great War*, 62. See also Jay Winter and Jean-Louis Roberts, ed., *Capital Cities at War: Paris, London, Berlin, 1914-1918* (Cambridge: Cambridge University Press, 1997).
[103] Vinen, *History in Fragments*, 54. This sentence is footnoted and attributed to Avner Offer, *The First World War: An Agrarian Interpretation* (New York: Oxford, 1991), 33.
[104] Davis, *Home Fires Burning*, 43.
[105] Ibid.

place, for food they might not even procure."[106] In this harsh struggle for the basic necessities of life, these women and their families barely survived.

Willy and his fellow classmates could not predict the future. Few could imagine the social and political chaos of the next six years, when Germany slid deeper and deeper into economic and political instability. Most likely, few of these students imagined coming into adulthood in an urban landscape that resembled a violent civil war amidst mass poverty and collective despair. They would come of age traversing city streets that grew louder and more dangerous with attempted coups, strikes, political clashes, and blatant violence. Probably very few of them could imagine the social impact of massive inflation, which would disrupt their lives completely.

Although these students could not anticipate the shape of things to come, several may have been skeptical about their future opportunities. It was not an encouraging time for the children of lower-middle-class families of merchants, businessmen, bankers, and civil servants. It may have helped that their studies in this "Realschule" privileged useful skills over classical learning. Still, having witnessed the devastating effects of the war on their families, hope was fleeting. Now, the teacher asked them to evaluate their horizons. What did they want to be when grown up and why?

Before Ley stood to announce his chosen career and his life ambitions, other students preceded him in their announcements. Ley remembered:

> Most of my classmates wrote very 'safe' papers. One wanted to be a doctor because his father was one—and he wanted to help humanity too, of course. Others had the Civil Service in mind, which was something that was likely to find approval. Some said they had to keep up the family tradition, meaning they would take over their father's business.[107]

[106] Ibid., 64-65.
[107] Willy Ley, *Willy Ley's Exotic Zoology*, illustrated by Olga Ley (New York: Viking, 1959), vii.

Young Willy probably had an easier childhood than some of his peers. He was born Willy Otto Oskar Ley on October 2, 1906 in Berlin. He was the son of Julius Otto Ley, a traveling wine merchant, and Frida (May) Ley, the daughter of a Lutheran church official. Ley saw little of his parents after the age of 7. When the First World War broke out, both of his parents were living in London, while Ley remained with his aunts in Berlin.[108] Julius was imprisoned in the Isle of Man until the end of the war. Like other civilians or captured soldiers, he was "protected from death in combat by having been captured."[109] Frida was allowed to return to Germany, carrying her newborn baby Hildegaard. According to some accounts, she did not remain in Berlin. After leaving the newborn with her sisters, she may have left to work as a milliner in a different city.[110] Willy's aunts were his primary care givers, along with a support network of other relatives tied to the German Lutheran Church.

These were the two sides of Willy's background: business and the church. Those were his two "safe" alternatives. He had to decide which path to take. He had little regard for family traditions. In fact, he had this advice for future historians:

> A possible future biographer will have a hard time finding family background for either the scientific or the literary side of my inclinations and activities. My

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[108] In a 1955 autobiographical note, Ley recalled, "It so happened that my parents were in London when that war broke out. I was in Berlin all the time, living with relatives…" See "Ley, Willy," *Twentieth Century Authors First Supplement* (New York: H. W. Wilson, 1955), 580.
[109] Audoin-Rouzeau and Becker, *Understanding the Great War*, 72.
[110] This tale is told in Sam Moskowitz, "The Willy Ley Story," *Worlds of Tomorrow*, May 1966, 32. The source of this information about her occupation as a milliner is unknown. Moskowitz wrote: "Willy Ley, through most of his childhood saw little of *either* parent. His father had the wandering itch. Leaving his wife and child with her parents, he traveled first to New York in 1910, eventually to open a German delicatessen in London in 1913. His wife joined him then, leaving Willy in the charge of her three sisters. When World War I broke out, she was sent back to Germany with her eight-month-old daughter, Hildegarde… Working at the millinery trade in another city, she saw her children only one afternoon every two weeks. The sisters took turns at being mother to them and fortunately did very well at the task." See Moskowitz, "The Willy Ley Story," 32. In a later article, Moskowitz quoted Ley's "close friend… Deborah Crawford," who claimed that his birth was illegitimate. Again, the source of this information is unknown. Skepticism is warranted. See Moskowitz, "Willy Ley: Prophet of the Space Age," *Fantasy Review* 99 (March, 1987): 13.

> mother's family consisted largely of employees of the German Evangelical (Lutheran) Church, with a number of unimportant craftsmen such as cabinet makers thrown in. My father was a business man (wine merchant), his father a blacksmith and the nearest approach to artistic occupation in the whole family was one of my father's brothers who was an assistant band leader in the German army.[111]

Unlike his family members and many of his peers, Ley possessed a creative side. He was a gifted student.[112] As a teenager, he eagerly read morning newspapers.[113] He was also intellectually curious about all subjects. For example, his Realschule may not have required traditional courses, such as Latin and Greek classics. Nevertheless, Ley learned Latin and read many of the Greek classics. His fascination with Homer and Greek mythology would last a lifetime. As can be judged by his later books, Ley loved reading the primary sources in their original languages. It is tempting to imagine Ley as a teenager, absorbing himself in Latin texts, as if they offered overlooked gems, waiting to be discovered by someone who did not simply rely on translations or secondary literature. This distrust of secondary sources would last a lifetime.

Like his fellow classmates, Ley was better off than the children of the lower working class, who were often forced to abandon schooling at a very early age when the use of women and children countered the shortage of labor.[114] Despite the everyday

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[111]"Ley, Willy," *Twentieth Century Authors First Supplement*, 580.
[112] In Ley's own words, he attended "in proper and prescribed order four years of municipal grade school before being entered on the rolls of an advanced school, also in Berlin." See "Ley, Willy," *Twentieth Century Authors First Supplement*, 580.
[113] In one of his last articles for *Galaxy*, Ley recalled a "fairly minor incident" in high school that he remembered "all through life." He recalled, "When I was in high school it so happened that I had to leave the house before the delivery man brought the morning paper. A classmate of mine who lived some distance away and presumably had another delivery man did get the morning paper in time to read it before he left for school." Ley's classmate brought a clipping that announced the conclusions of Lord Rutherford of Nelson, who announced, according to the newspaper, "Nitrogen Not an Element." Ley remembered, "As soon as our science teacher entered the classroom we raced up to the desk and showed him the clipping." Ley's science teacher apparently rejected the clipping offhand, stating, "Professor Rutherford is one of the greatest living scientists, but I know that nitrogen *is* an element." This is one of many of Ley's descriptions of his schoolteachers as stubborn and unimaginative. See Willy Ley, "For Your Information," *Galaxy*, October 1969, 101.
[114] Mary Fulbrook, *A Concise History of Germany* (Cambridge: Cambridge University Press, 1990), 157.

effects of the war on Berliners, many of these lower middle-class students attended school uninterrupted. That privilege only shielded them so much. To quote historian Mary Fulbrook, "Psychologically, people's horizons and perceptions had been changed by wartime experiences in a variety of ways…"[115] Historian Richard Vinen also argued, "The consequences of the First World War reached into the most intimate areas of private life, and now views about human nature changed."[116]

So too did views of science and technology.

The Heroic Engineer

Historian Michael Adas famously argued that the war served as a "technological maelstrom" that diminished or destroyed many of the hopes and dreams of a previous generation of intellectuals.[117] Machine guns, tanks, mortars, poison gas, and other innovations of the era transformed war from an honorable and noble enterprise into an industrialized assembly line of human carnage. In this sense, the Great War facilitated a "crisis of Western Civilization."[118] Adas argued:

> [O]ne of the prime casualties of the trench debacle was the age-old notion of war as an honorable and valorous enterprise in which youths were initiated into manhood and nations proved their mettle in the struggle for survival of the fittest… Little that was glorious or noble could be found cowering in ditches in the midst of a wasteland glutted with the bloated bodies of dead men and animals whose stench carried miles to the rear.[119]

[115]Ibid., 157.
[116] Vinen, *History in Fragments*, 75.
[117] Michael Adas, *Machines as the Measure of Men: Science, Technology, and the Ideologies of Western Dominance* (Ithaca: Cornell University Press, 1989), 371-372.
[118] Ibid., 365.
[119] Ibid., 371.

In the perspective of famous trench soldier Ernst Jünger, science and technology had converged to create "a cosmic, soulless force before which man almost disappeared."[120] Historians have analyzed similar perceptions of the loss of chivalry amidst industrialized warfare. The Great War was a watershed moment that caused many European intellectuals to not only question their faith in machines as the measure of man but also reevaluate their very notions of civilization and progress. Adas wrote: "The mechanized slaughter on the Western Front corrupted or undermined the credibility of most of the ideals and assumptions on which the Europeans had based their sense of superiority to all other peoples and from which they had fashioned that ideological testament to their unprecedented hubris, the civilizing mission."[121]

Ley and his fellow students viewed these events in less highbrow ways. Even though they had endured the civilian effects of "total war," there was no moment of great disillusionment with technology and science. It is doubtful that Ley or his fellow students thought in terms of the ideologies of Western dominance or the "measure of man." Instead, Ley belonged to a generation that would continue to celebrate technologies and other modern marvels, especially airships and airplanes. In fact, Ley recalled, "One of my earliest memories is seeing one of the airships built by Count Ferdinand von Zeppelin circling over Berlin. A few years later I was taken out to a remote suburb to see an airship on the ground."[122] Like many of his fellow classmates, Ley celebrated new heroes, embodied in the image of the aviator and the "war ace." As explained by historian Peter Fritzsche, the dual image of the war ace bolstered notions

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[120] Ernst Jünger, "Materialschlacht," *Standarte*, 1, 5 (October 4, 1925). Quoted in Eric Leed, *No Man's Land: Combat Identity and World War I* (Cambridge: Cambridge University Press, 1979), 154.
[121] Adas, *Machines*, 372.
[122] Willy Ley, "Are We Going to Build a Space Station?" *Galaxy*, December 1962, 133.

of chivalry in the air: "Both images, the familiar knight in the air and the steeled machine-man, figured in popular ideas about the fighter pilot."[123] The war ace became a symbol for the continuity of chivalry. He was a both a noble warrior and a skilled engineer.

For both young and mature Germans, celebrations of the war ace or the daring engineer were not free of ideological sentiments. Historian Eric Leed described a common perception of the pilots: "Their machines enabled them to rise to a height where, once again, war was a unified human project."[124] In the words of Ernst Jünger, "When they soar into heights from which the front appears as a thin network of lines… [there occurs] in their risky enterprise a fiery marriage of the spirit of ancient chivalry and the chilling bleakness of our forms of labor."[125] The sky warriors retained control over their tools. Their skill and daring still mattered. Jünger further commented: "In them one finds the highest workerly and soldierly virtue stamped in fine metal, combined with intellect applied to the tasks in hand, and not without a certain freedom of style and an aristocratic delicacy."[126] Fire and steel joined forces in the conquest of the sky.

Celebrations of the aerial warriors circulated in both juvenile and adult literature. Ley himself grew quite fond of the "Captain Mors" adventures, which were

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[123] Peter Fritzsche, *A Nation of Fliers: German Aviation and the Popular Imagination* (Cambridge and London: Harvard University Press, 1992), 64.
[124] Leed, *No Man's Land*, 136.
[125] Ernst Jünger, *Werke*, I, 368
[126] Quoted and translated in Marcus P. Bullock, *The Violent Eye: Ernst Jünger's Visions and Revisions on the European Right* (Detroit: Wayne State University Press, 1992), 152. See also, *Ernst Jünger and Germany: Into the Abyss, 1914-1945* (Durham: Duke University Press, 1996).

the closest thing to pulp science fiction stories in Germany.[127] They told the tales of an exotic pilot who led exciting aerial adventures around the world and even into space. Unlike much of the "detective or Wild West stuff," which circulated as dime novels, Germany's "Captain Future" was "outright science fiction," and the novels "showed evidence of wide reading and even research on the part of their author."[128] The young Willy particularly enjoyed these wild tales of earthbound and cosmic exploration. Mors' aerial adventures to Tibet to "obtain the secret of a powerful high explosive" was as memorable as his attempts to divulge the secrets of Martian solar energy weapons and Venusian "heat-beams."[129] Despite the odds, Captain Mors always prevailed, usually saving his ship "by fast and frantic manoeuvring [sic]."[130] It is doubtful that Ley considered the ways in which his enthusiasm for "Captain Mors" related to a perceived loss of chivalry and masculinity on the ground and in the trenches. He also did not consider how his love of the war ace might be a sign of "reactionary modernism," in which a camp of intellectuals allegedly reconciled modernist and antimodernist cultural values.[131] Like most Germans, young and old, he was simply fascinated with technology and optimistic about the future, in spite of the Great War. There was no watershed moment of grand disillusionment with science, technology, and Western values.

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[127] Willy Ley, "Willy Ley Recalls 'Captain Future' of Germany," in *Science-Fantasy Review* 3:16 (Autumn 1949): 2-4. He argued, "all-fiction magazines, as far as my knowledge goes, did not exist, either in 'slick' or 'pulp' form."
[128] Ibid., 3.
[129] Ibid.
[130] Ibid., 4.
[131] See Jeffrey Herf, *Reactionary Modernism: Technology, Culture, and Politics in Weimar and the Third Reich* (Cambridge: Cambridge University Press, 1986). Herf outlines his "basic point" as "Before and after the Nazi seizure of power, an important current within conservative and subsequently Nazi ideology was a reconciliation between the antimodernist, romantic, and irrationalist ideas present in German nationalism and the most obvious manifestations of means—ends rationality, that is, modern technology." See Herf, 1.

The Heroic Scientist

During his teenage years, Ley enjoyed other science fiction tales. By far, his favorite fictional writer was scientist/philosopher Kurd Lasswitz, whose book, *Auf Zwei Planeten* (1897), occupied a special place in Ley's collection. As "one of the best and most interesting novels of German literature," the book had a lasting impact.[132] Ley was not so impressed with the novel's utopian elements, as well as its social commentary. The book invited readers to reflect upon the history of European imperialism and first contact with non-Western cultures by conceptualizing similar events through the lens of a Martian occupation of earth. To quote scholar William Fischer, the book still reads as a remarkable literary exploration of "the nature of superiority, the value of knowledge, and the meaning of humanity…"[133] This morality tale did not escape Ley, although he summarized the plot rather crudely: "It was… basic psychology to show that the highly ethical Martians, when confronted with terrestrial stubbornness, quickly revert to war, fought in a highly efficient manner with a minimum of actual killing."[134] Ley was far more intrigued by Lasswitz' "solution to the problem of space travel."[135] Although the story contained "marvelous but impossible" means of interplanetary travel, the narrative also included Lasswitz' mathematical calculations of trajectories, orbits, and the timing of launches. Ley recalled, "It was all worked out so well that most readers, as one critic

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[132] Willy Ley, *Mars, der Kriegsplanet* (Hachmeister and Thal, 1926), 5. Literary scholar William B. Fischer calls *Auf Zwei Planeten* the "greatest work of German SF." See William B. Fischer, *The Empire Strikes Out: Kurd Lasswitz, Hans Dominik, and the Development of German Science Fiction* (Bowling Green, Ohio: Bowling Green State University Press, 1986), 11. For an excellent literary and cultural analysis of the novel, see chapter 4.
[133] Fischer, *Empire Strikes Out*, 125.
[134] Ley, *Rockets and Space Travel: The Future of Flight Beyond the Stratosphere* (New York: Viking, 1947), 49.
[135] Ley, *Rockets and Space Travel* (1947), 49.

put it, did not even notice that these pages of the book (only a score or so) presented a number of new ideas."[136]

Ley was also influenced by a different science fiction author: Jules Verne. Like other French writers, Verne "expressed confidence in the powers of science and discovery, a confidence well fortified by the fact that during the preceding half century a number of important inventions had been put to work."[137] According to Ley, these adventures were also "romantic," since they recounted "explorations of the unknown…"[138] Unlike the soldiers in the trenches, the daring scientists/engineers of Verne controlled their machines and inventions like technical knights. Men of science crossed political boundaries to traverse the earth in the air. These adventurers discovered especially weird things in the depths of the ocean. Rarely did they get wrapped up in political limitations. Instead, politics got out of the way in lieu of marvelous inventions, wondrous machines, and daring adventurers.

In other words, Ley consumed an image of the scientist that conforms with Roselyn D. Haynes category of the "scientist as adventurer." In *From Faust to Strangelove: Representations of the Scientist in Western Literature*, Haynes described the common tropes surrounding "the figure of the adventurer-scientist, a modern counterpart of the Romantic hero, but now allied with science rather than opposed to it."[139] Haynes continued: "Heirs to the optimism of both the Utopian tradition and wonderful-journey stories, these characters entered into the popular culture of their time

[136] Ibid., 51.
[137] Ibid., 42. Here, Ley is speaking most directly about a novel by Achille Eyraud, before adding, "It was the same feeling which produced Jules Verne."
[138] Ibid.
[139] Roselyn D. Haynes, *From Faust to Strangelove: Representations of the Scientist in Western Literature* (Baltimore and London: The John Hopkins University Press, 1994), 129.

as humanity's advance guard, extending the frontiers of experience, whether in space or time, confident of subduing to their will whatever they found there and transcending mankind's former limitations."[140] These "technological knights" boldly expressed their "right to dominate nature, the universe, or whatever alien societies they encountered."[141]

For Haynes, the early works of Jules Verne exemplified these ideas and representations, as well as the "belief that scientific discovery was the greatest of all adventures and that European man would progressively master nature…"[142] She wrote:

> Verne's debonair and irrepressibly optimistic heroes are bent on adventure, courageously risking their lives for the delight and the honor of the quest. But this intrepid exploration is presented as more than entertainment. These myths of conquest, wherein the marvels of science engage with and overcome the marvels of nature, are an expression of logical positivism with a strongly didactic subtext, intended to elicit… a spirit of bravery, optimism, and reverence for scientific knowledge…[143]

The scientist was a swashbuckling adventurer who displayed "bravery, coolness in the face of danger, and self-sacrifice…"[144] He also displayed anti-authoritarian tendencies. He was an "exotic traveler who transcends all boundaries accepted by others…"[145] He spit in the face of conventional wisdom. He doubted the reliability of established thought. He would hatchet his way through thick jungle bush to discover the truth about the world. Often, he debunked popular superstitions. In Ley's own memories, Jules Verne represented "a new attitude."[146] He remembered, "Consistently his heroes (who are, of course, merely personifications of the scientists, engineers, and explorers of the nineteenth century) do things for themselves. They do them in a novel way. They don't

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[140] Ibid.
[141] Ibid., 129-130.
[142] Ibid., 130.
[143] Ibid., 130-131.
[144] Ibid., 138.
[145] Ibid.
[146] Ley, *Rockets and Space Travel* (1947), 42.

do things in a traditional and poor and inefficient manner for the sake of tradition. Nor do they look for 'lost arts.'"[147] Ley drove this point home as clearly as he could:

> Instead of yielding to the traditional modesty of being "insignificant sons of great ancestors," they act with the full knowledge that their time has surpassed any preceding time. They know that they know more than their ancestors… They expect their sons to be better than they are and they expect the future to be greater than the present. They don't hesitate to cruise under the seas or fly through the air. And to them the problem of reaching the moon is what it really is: a question of attaining a sufficiently large velocity in the right direction at the proper time.[148]

As other scholars have long noted, Verne's *Les Voyages extraordinaires* not only stimulated the imaginations of young readers, but also interested them in "the connection between the past and the future, between the real and the possible."[149] Verne "combed the society of his time for clues pointing to the future development of humanity. Man, he believed, would become progressively more and more capable of mastering nature, of extending his domain over the earth."[150] Verne also expressed a deep fascination with the United States as a land of "borne mechanics and engineers." This image of the United States must have influenced Ley. Over half of Verne's novels took place at least partially on American soil. In fact, Florida was the launch site of man's journey to the moon. As noted by literary scholars: "American society is seen by Verne as one in which scientific and technical problems are of concern to the man on the street corner. They belong to the people, rather than being set apart as they are in the Old World, in the dusty studies of the Academies and scholarly societies."[151] America was a great scientific and industrial frontier.

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[147] Ibid., 42.
[148] Ibid., 42.
[149] Jean Chesneaux, "Jules Verne's Image of the United States," *Yale French Studies* 43 (1969): 111.
[150] Ibid.
[151] Ibid., 113.

The imaginary voyages of Jules Verne deeply influenced the young Ley. He later claimed that Verne's moon voyage planted a "seed" within him that eventually blossomed. Beyond influencing his thinking about a moon voyage, Verne's stories left a mark on Ley's psyche. Not only did they contribute to his fascination with the United States, but also they impressed upon him an image of the scientist as a bold adventurer and explorer, who bravely set out to face the unknown and conquer new frontiers. He saw nothing destructive about the conquest of nature. Like centuries past, nature would yield her secrets. The scientists would penetrate her secret realms to dominate, reorder, and repurpose her spoils for the benefit of mankind. The riches of the frontiers would be marvelous. Most likely, as he and his family struggled for basic sustenance like bread and potatoes, Ley dreamt of those riches.

The Heroic Science Writer

The wartime and early postwar years also marked the beginning of Ley's scientific career as he "grew up, so to speak, in the shadow of the Museum of Natural History in Berlin."[152] While "playing hookey [sic] from Sunday School," Ley explored every nook and cranny of this museum.[153] He later expressed his surprise at the exciting discoveries made in less traveled hallways and exhibits. "I spent much time in wonder," he recalled. He discovered "especially weird things in it."[154] "My first love," he remembered, "had been fossil animals."[155] In fact, one of his fondest memories of the museum surrounded a "special hall devoted to paleontology" which included "a whole

[152] Ley, *Exotic Zoology*, vii.
[153] "Ley, Willy," *Twentieth Century Authors First Supplement*, 580
[154] Willy Ley, "Monsters of the Deep," *Galaxy*, February 1959, 99.
[155] Willy Ley, "How It All Began," *Space World*, June 1961, 24.

wall of chirotherium prints."[156] Ley recalled, "Almost all the way to the high ceiling it was 'paneled' with large slabs of red sandstone which was even more intensely red because of the sunlight that struck them slantwise through tall windows."[157] He added, "One turned away from that wall of red sandstone with a sense of mystery."[158] Soon, his mind turned to astronomy, zoology, and botany before his interests were "superceded by paleozoology and paleobotany."[159] He later explained: "the past periods of earth's geological history fascinated me [to] no end."[160] According to later publicity material: "He was, from his early high school days, fascinated not only in all aspects of scientific fact, but by the history behind scientific discoveries."[161]

Ley was also an avid reader of popular science, and his bookshelf included popular astronomical books by Dr. M. Wilhelm Meyer, director of the Urania Observatory in Berlin.[162] Ley later recalled, "One of the first books I ever bought—a mixture of curiosity and nostalgia—was a small volume by the German astronomer… called *World's End*."[163] His bookshelf also contained three volumes of Alexander von Humboldt's *Kosmos*.[164] Other authors included Camille Flammarion, Richard Proctor, and Percival Lowell. Most likely, Ley read many of the Kurd Lasswitz' non-fictional

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[156] Willy Ley, *Dragons in Amber: Further Adventures of a Romantic Naturalist* (New York: Viking, 1951), 69.
[157] Ibid.
[158] Ibid.
[159] "Ley, Willy," *Twentieth Century Authors First Supplement*, 580.
[160] Ibid.
[161] *The Scanner: A Monthly Publication of the Manmouth County (N.J.) Sub-Section Institute of Radio Engineers*, February 1956, 3.
[162] Ley, "Willy Ley Recalls," 3. Ley also stated in an interview: "Like every future author or scientist I ever heard of, I was an omnivorous reader, first in German only and then, as schooling progressed, in Latin, French, and English too." Ley, Willy," *Twentieth Century Authors First Supplement*, 580.
[163] Willy Ley, "For Your Information: Death of the Sun," *Galaxy*, March 1955, 54.
[164] In a later edition of *Galaxy* magazine, Ley spoke of recently rereading the third volume. He expressed his fond admiration of von Humboldt's dogged ability to debunk local legends and myths. Regarding the belief that the stars can be seen during the day by looking up through a mineshaft, Humboldt grew "annoyed." Ley recalled, "Being Humboldt, he had traced the whole history of the idea." See Willy Ley, "Any Questions?" *Galaxy*, April 1962, 84.

books, such as his *Die Lehre Kants von der Idealität des Raumes und der Zeit* (1883), which explained Kant's philosophy for a general audience.[165] Ley may have also read Lasswitz's compelling essays, which first appeared in newspapers and magazines. For example, in a 1910 edition of *Frankfurter Zeitung* (later reprinted in essay form), Lasswitz mused:

> Ever since science has incontrovertibly made the Earth into a planet and the stars into suns like our own, we have not been able to lift our gaze to the starry firmament without thinking, along with Giordano Bruno, that even on those inaccessible worlds there may exist living, feeling, thinking creatures. It must seem absolutely nonsensical indeed that in the infinity of the cosmos our Earth should have remained the only supporter of intelligent beings [Vernunftwesen]. The rational order of the universe [Weltvernunft] demands that there should necessarily even be infinite gradations of intelligent beings inhabiting such worlds...[166]

Lasswitz then wrote of "the profound and inextinguishable longing for better and more fortunate conditions" on other worlds.[167] Most likely, Ley read these words in a later collection of Lasswitz' essays.

In many ways, Ley was among the audience that continued to consume science, as presented by scientists, science writers, and journalists in the early twentieth century. During later periods, Ley would express a disapproval of the isolation of scientists into disciplines. This perception of a "retreat" or a "reluctance to engage" would motivate him in years to come, as he saw an opportunity to fill in the gap between the scientists and a curious public. Yet, as a teenager, he benefited from a continued engagement on

[165] See Fischer, *Empire Strikes Out*, 311, note 3. It is noteworthy that Lasswitz also tried his hand at writing a history of science, titled *Die Geschichte der Atomistik vom Mittelalter bis Newton* (1890).
[166] Translated and quoted in Fischer, *Empire Strikes Out*, 63.
[167] Ibid.

the part of numerous individuals who did not simply retreat from the public. Instead they engaged.[168]

This engagement is documented most directly in other national contexts, whereas the German context is still understudied.[169] Yet, many of these interpreters or popularizers must have benefited from the same types of developments that occurred in Great Britain and the United States. For example, the mass circulation of newspapers brought science directly to the public. In the German context, this presentation often involved the celebration of technology as evidence of national ingenuity. Like other countries, there was a growing market for educational texts, particularly in Berlin, which had become a cosmopolitan center for the distribution of media. Historian Peter Bowler's claim about Great Britain could be applied to the Berlin scene: "As the size of the reasonably well-to-do reading public expanded, there were increasing opportunities for the publication of books that were educational in a less formal way."[170] The continued emergence of a mass market did not further isolate science from the public. Instead, it brought "science for all," as it was presented by scientists, science writers, and a host of individuals who may not have been formally trained, but nevertheless acquired a public image as scientific authorities on a wide range of subjects.

Historians often view this situation as a "battleground," in which the scientist (or the "scientific community") is poised as a combatant in public discourse. For example,

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[168] In *Science for All*, Peter Bowler argues that the historical focus on popular science during the nineteenth century often obscures the continuity and longevity of popular science writing, as it flourished in the twentieth century. Historians typically argue that the rise of professions marked the end of an era, in which popular science had flourished, while "Victorian science was shaped by the interaction between working scientists and the general public." See Bowler, *Science for All: The Popularization of Science in Early Twentieth-Century Britain* (Chicago and London: The University of Chicago Press, 2009), 1-2.
[169] See, for example, Andreas W. Daum, *Wissenshaftspopularisierung im 19 Jarhundert* (Munich: Oldenbourg Wissenschaftsverlag, 1998). For an excellent introduction to the historiography of popular science, see focus section: "Historicizing 'Popular Science,'" *Isis* 100 (2009): 310-368.
[170] Bowler, *Science for All*, 9.

Bowler explained the German context: "[P]opular science remained an active field in which battles over the role of science in middle-class culture were fought out."[171] In more direct language about the broader context, he wrote, "Popular science was a battleground both for rival ideologies and rival worldviews."[172] Likewise, historians of other contexts often present a dichotomy or a distinction between legitimate scientists and the public understanding of science, as scientific ideas circulated in mass media.[173] The interaction of scientists and the public is usually presented as a battle to combat a "deficit" or wage a war against pseudoscience.[174] Or, the conflict is presented as a counter-attack by the scientific community.

No doubt Bowler and others are correct to emphasize the continuity of popular science, as many scientific thinkers continued to write for lay audiences, even after the supposed retreat into disciplines. However, this continuity should not obscure the fact that there was a growing market for "interpreters," such as journalistic science writers who occupied a middle ground between two camps. In some cases, even thinking in terms of a "middle ground" obscures the fact that publicly recognized "scientists" did not fit neatly into scientific professions. It is certainly interesting to study individuals within scientific communities who did not adhere to a "prohibition on popular writing."[175] But, perhaps historians are too quick to draw lines of demarcation. We are not simply dealing with scientists who used new media in new ways. Instead, we should study how the rise of new media and its consumption created and sustained a new type

[171] Ibid., 3.
[172] Ibid., 24.
[173] See, for example, the works of Marcel C. LaFollete and John C. Burnham.
[174] See Michael Gordin, *The Psuedoscience Wars: Immanueal Velikovsky and the Birth of the Modern Fringe* (Chicago and London: The University of Chicago Press, 2012).
[175] Bowler, *Science for All*, 2.

of public intellectual whose "profession" could be far removed from research and experimentation. Much more could be said about "a new breed of science journalism" that flourished in the explosion of postwar mass media.[176] It is no coincidence that science journalism tended to focus on areas in "where there was still some interaction between the professionals and the most dedicated amateurs."[177] In turn, scientific journalists often wrote about astronomy and natural history, where the lines of demarcation remained loose throughout the 19th and 20th centuries. What Bowler asserts, in the context of Great Britain, could again be applied to other contexts: "In both astronomy and natural history, the Victorian tradition of popular writing continued seamlessly into the new century."[178]

While the rise of the "science editor" in newsprint can be seen most directly in the 1920s and 1930s, it was a profession that grew out of continuity with the 19th century, as the public demanded news of fantastic discoveries of great unknowns, whether in the cosmos or the less traversed areas of the Earth. These journalists and other writers of popular science delighted middle-class reading audiences. The press was a more comfortable arena for "hacks" and hoaxes, while the book trade could be a more hospitable place for educational books aimed at young men like Willy Ley. Like other children and young adults, he read a "new generation of popular science books…aimed at readers who were somewhat less well-prepared for study, but were anxious to learn as long as the material was presented in a sufficiently palatable

[176] Ibid., 54. Interwar scholars have made the most progress in Soviet historiography. In particular, see James T. Andrews, *Science for the Masses: The Bolshevik State, Public Science, and the Popular Imagination in Soviet Russia, 1917-1934* (College Station, TX: Texas A&M University Press, 2003); See also, Asif S. Siddiqi, *The Red Rockets' Glare: Spaceflight and the Russian Imagination, 1857-1957* (Cambridge: University of Cambridge Press, 2010).
[177] Ibid., 55.
[178] Ibid., 63.

form."[179] These books, as Bowler argues, may have flourished more readily in Great Britain. Their authors greatly benefited from many earlier changes such as "a massive revolution" of newspapers, an "ever-expanding public that was literate," and new production techniques that made print media cheaper to consume.[180]

One could make similar claims regarding cosmopolitan Berlin. Ley, like many of his classmates, wanted "a cut-down version of what might be found in a textbook, presented in a manner that was easy and entertaining for the amateur student to read."[181] Coverage of science may have declined in British magazines during the war and even into the 1920s, while Germany somewhat lacked comparable styles of mass media.[182] Nevertheless, the circulation of *Wissenschaftspopularisierung* indicates a far more open and inclusive genre than can be seen in the context of Great Britain.[183] One could also connect the wide circulation of natural history texts to various back-to-nature movements that stretched from *Wandervogel* activities to the survival of German popular romanticism. A closer examination of context of Germany in the early twentieth century may further reveal that the "British case—like any other national setting—is anything but representative of others."[184] The German context may reveal unique forms of popularization that, in the words of historian Andreas Daum, included "multidimensional processes of communication among a plurality of knowledge

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[179] Ibid., 79.
[180] Ibid., 196.
[181] Ibid., 81.
[182] Regarding the British context, Peter Broks' *Media Science before the Great War* shows a decline in science coverage in British magazines. Likewise, Peter Bowler sees a further decline during the interwar period. These studies distinguish between science and technology. Historians of technology, on the other hand, see a dramatic increase of press coverage. More studies are warranted.
[183] See Andreas W. Daum, "Varieties of Popular Science and the Transformations of Public Knowledge: Some Historical Reflections," *Isis* 100 (2009): 319-332. See also, Andreas Daum, "Science, Politics, and Religion: Humboltian Thinking and the Transformation of Civil Society in Germany, 1830-1870," *Osiris* 17 (2002): 107-140.
[184] Daum, "Varieties," 324.

producers, audiences, and public sites, with each of these ideal type factors assuming reciprocal and changing roles that may overlap."[185]

While the Great War and the postwar economic chaos disrupted the publishing trade, Ley likely read many of the popular science books shelved in Berlin libraries. He also cherished his growing collection of books. Most likely, he did not regard these works as the simple "diffusion" of expert opinions to the masses. Instead, they encouraged him to think for himself. They inspired him to think scientifically and investigate the world. For example, Ley's favorite science writer was a German, Dr. Theodor Zell, whose popular histories of animals and animal fables fascinated Ley immensely.[186] In some ways, "Dr. Cell" was a new type of scientist, using a pen name to fashion himself into a scientific personality, capable of educating and entertaining the public through books aimed at a mass audience. "His specialty," Ley recalled, "was to explain actions of animals which seem mysterious or senseless to the casual observer."[187] Although Zell never experimented with animals, his observations and writings made him (according to Ley) one of the most skilled debunkers of zoological myths. For example, Zell invalidated the myth that one could distinguish between the pups of dogs and wolves by how they drank. According to popular Polish and Russian stories, young wolves "drink like sheep." Ley wrote:

> Nobody ever doubted that story. Everybody had learned it early in life from his father. Except Dr. Zell. He had grown up with lots of dogs and had seen wolves. There was no difference in the build of the mouth; why should there be one in drinking habits? "It took one trip to the zoo," he wrote, "but then it took

[185] Ibid., 322.
[186] Willy Ley, "For Your Information: The Man I Didn't Meet," *Galaxy*, August 1961, 131-141. See Theodor Zell, *Neue Tierbeobachtungen* (Stuttgart: Franckh, 1919); *Straußenpolitik: Neue Tierfabeln* (Stuttgart: Franckh, 1907); *Moral in der Tierwelt* (Stuttgart: Franckh, 1920).
[187] Ley, "The Man," 133.

> five hours of patience." After that time all three species of wolves had performed for him, all of them lapping the water like his own dogs."[188]

Ley greatly admired this ability to debunk false claims, particularly those fables and myths that circulated widely without being scrutinized. He appreciated the role of a popular science writer when it came to setting the record straight. "Dr. Cell" did not need to conduct elaborate experiments in an isolated laboratory. He simply had to observe nature. He also uncovered scientific truths by exposing the origins of myths and legends. He combined history and science. Overall, he was part of a scientific community, which continued to embrace "the role of the public intellectual and the effort to teach ordinary people about science."[189] He learned to navigate the book trade, while negotiating with publishers. He replaced jargon with common sense. Mostly, he inspired readers to wonder.

In this regard, "Dr. Cell" was similar to the authors of many books on popular science, as well as magazine articles that circulated in Great Britain and the United States. Peter Bowler's description of British magazines could be applied to other contexts and other genres: "What leaps out at the modern reader of this more positive material is the use of language designed to create a sense of awe and wonder at what was being achieved."[190] Material aimed at younger audiences often titled themselves with terms such as "wonders," "marvels," and "romance."[191] Their educational value was obvious, while their entertainment value lay in provoking emotional responses, such as a reverence for the complexities of Nature, with a capital N.

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[188] Ibid., 134.
[189] Bowler, *Science for All*, 5
[190] Ibid., 55
[191] Ibid.

Ley also greatly enjoyed the works of naturalist, science writer, and *Freie Bühne* editor Wilhelm Bölsche.[192] Most likely, Ley purchased personal copies of Bölsche's *Festländer und Meere im Wechsel der Zeiten* (1913), *Tierwanderungen in der Urwelt* (1914), *Der Stammbaum der Insekten* (1916), and *Eiszeit und Klimawechsel* (1919).[193] He also adored Bölsche's more famous works, such as *Das Liebesleben in der Natur* (1898) and *Der Sieg des Lebens* (1905).[194] Ley was impressed by Bölsche's style of writing as well as the use of illustrations and paintings to convey the mysteries of the planet and its strange creatures.

In fact, Bölsche's combination of science, poetry, artistic imagination, and literary prose reinforces Andreas Daum's broader point about the expansiveness of *Wissenschaftspopularisierung*. In the preface to a new edition of his most famous book, *Das Liebesleben*, Bölsche wrote:

> My book is addressed to all rational people who have the courage to form a philosophy of life for themselves. The world is a tough place and he who would pass through it must fear neither heaven nor hell. Of course, I refer to mature persons. But by mature persons I mean those who have experienced the hour of awakening, when the impulse for knowledge has stirred within them, when they realize that our fleeting human existence, our mad chase through the few years of our life with all its deceptions, is utterly vapid unless we give it a higher significance through knowledge, through that little candle, thought, which has been granted us to light our way in the gloom.[195]

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[192] An inventory of Ley's personal library reveals that he possessed nearly every book by Wilhelm Bölsche, each in the original edition, which indicates that these books may have been purchased in Germany and later sent to the United States in 1935. Before escaping Nazi Germany, Ley mailed a large crate of his favorite books to New York. This chapter assumes that many of pre-1935 German books in his library in 1969 were among the lot of books that he shipped in 1935. All listed works of Bölsche can be found in the inventory of Ley's library.

[193] Wilhelm Bölsche, *Festländer und Meere im Wechsel der Zeiten* (Stuttgart: Franckh'sche Verlagshandlung, 1913); *Tierwanderungen in der Urwelt* (Stuttgart: Franckh, 1914); *Der Stammbaum der Insekten* (Stuttgart: Franckh, 1916); *Eiszeit und Klimawechsel* (Stuttgart: Franckh,1919).

[194] Wilhelm Bölsche, *Das Liebesleben in der Natur* (Florenz and Leipzig: Diederichs, 1898); *Der Sieg des Lebens* (Stuttgart: Kosmos,1905).

[195] Wilhelm Bölsche, *Love-Life in Nature: The Story of the Evolution of Love*, trans. Cyril Brown (New York: Albert and Charles Boni, 1926), v.

He then offered no apologies for the tone of the book, which combined personal reflections, philosophical ruminations, and scientific theories. He explained: "The bridge connecting the field of the strictly scientific, in which true and half-true facts are assembled, with the world of sovereign thought, which seeks the whole, leads across art, art with all its instruments, even humour."[196] Bölsche also rejected the need for a "special solemnity of tone," when it came to presenting scientific and philosophical material for lay audiences.[197] He argued, "An artificial assumption of dignity is an absurdity when pure, genuine human beings get together."[198]

The book then takes readers directly to the sites of wonder, discovery, and awe, while the author speaks directly to those readers. For example, the text reads:

> I should like to discuss many things with you… But look out into the boundless brilliance of the sea. Out of this spotless blue, life emerged, moving and changing in thousands and thousands of forms and rising up even to you. Look into the firmament above and behold its infinite dazzling purity. Out of this blue of eternal space the worlds rained down like silver dust. How many alarming, horrible things the depths of this flood concealed, and still conceal. And yet, on the whole, it is a wondrous blue, into which the soul dives as into a bath of peace.[199]

Other parts of the text reinforce the readers' spiritual and scientific connection to a cosmic whole. "You are on earth and the stars are above you," he argued, "In the widest sense, you are a cosmic body as they are. Size matters nothing… You and Sirius both of you swim in the fine cosmic substance which the physicist calls the ether, like two fish in the same vast pond."[200] Additionally, volume one ends with this passage about the need to abandon the "old Bible picture" of nature:

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[196] Ibid., vi.
[197] Ibid., v.
[198] Ibid.
[199] Ibid., 5.
[200] Ibid., 419.

> Only one who has entirely rid himself of such a conception and made himself perfectly free and independent, will gain an unprejudiced understanding of how closely the paths of poetic invention and scientific investigation really do continually touch in the human spirit and how necessarily they must soar to similar symbols from similar simple observation of certain fundamental phenomena, which are present to the mind to-day and which were present to the mind thousands of years ago, because after all they are both guided by the same logic.[201]

One might read certain parts of Bölsche as confirming aspects of "science popularization as a secular, antireligious weapon."[202] At the same time, the spiritual and romantic tones of the text cannot be ignored. Bölsche blended genres. Like other popularizers and performers, he "poeticized science, made knowledge tangible, and enchanted audiences."[203]

Bölsche also explored the fringes of zoology, while encouraging his readers to become fellow naturalists and science lovers. He spread the message of humanistic naturalism. As part of this crusade to bring science to the people, Bölsche always promoted a deep connection between the scientific spirit and the poetic imagination of human beings. He hoped that a love for science would provide the means of upward mobility, which is why he helped to create Germany's first *Volkshochschule*. His efforts inspired Ley deeply, as did the ideas within his books.

Some scholars, especially Alfred Kelly, have attempted to discount Bölsche's popularity, because his works complicate our understanding of a public disenchantment with science and technology following the carnage of the Great War. For example, Kelly argued that Bölsche's books offered readers "an escape to the past, rather than a

[201] Ibid., 504.
[202] Daum, "Varieties," 328. Daum highlights how new views are increasingly questioning this traditional model of science v. superstition.
[203] Ibid., 329.

guide to the future…"[204] Accordingly, this type of popular science was "ill-adapted to a generation glutted on horrors and suffering…" Many other scholars have made similar claims about the public perception of science in the wake of trench warfare. For example, Nick Hopwood reiterated a scholarly consensus that "public interest in science fell, and many who had nurtured a positive image of scientific progress now associated the sciences with poison gas."[205]

These books do not reflect popular and escapist longings for an untarnished past. Instead, they illustrate the continuity of popular writing on natural history, in spite of the efforts of later historians to create a schism. They also illustrate how German popular science could be embodied by an individual who was quite different from a professional scientist using mass media to disseminate a specific set of knowledge claims, professional values, and status reinforcements. Rather, Bölsche displayed a "dedication to education" combined with a struggle to make a living by "surviving in the columns of natural science journals."[206]

Ley respected the efforts of Bölsche and other science writers, as well as the efforts of science fiction authors. Overall, during his teenage years, popular science and science fiction had been Ley's twin interests, pulling him toward a specific direction in life. He learned to see the world in terms of wonder. He marveled at the mysteries. He looked to the future with an enthusiasm for science and technology. He believed that he lived in a new age of scientific discovery. Science was open to all.

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[204] Alfred Kelly, *The Descent of Darwin: The Popularization of Darwinism in Germany 1860-1914* (Chapel Hill: University of North Carolina Press, 1981), 145. Quoted in Nick Hopwood, "Producing a Socialist Popular Science in the Weimar Republic," *History Workshop Journal* 41 (1996): 119.
[205] Hopwood, "Producing a Socialist Popular Science," 118.
[206] Andreas Daum, *Wissenschaftspopularisierung im 19. Jahrhundert*, 451, translation by Charles E. McClelland in his review. See McClelland, "Review," *The Journal of Modern History* 72 (2000): 828.

The Heroic Explorer

Although these perspectives crystallized during his teenage years, the seed had been planted back in 1917, when he first answered his teacher's question. "I want to be an explorer," he announced. The reaction of his teacher, as he recalled, was patronizing and unimaginative:

> I forgot what reasons I gave. I do remember that my teacher made a little speech, saying that I deserved a good mark for my style and that the reasoning, "such as it was," was logical too. Except that the whole thing was, of course, nonsense. A boy with a family background of business on one side and church on the other just doesn't want to be an explorer, or, if he does, he certainly won't become one.[207]

The speech left him unconvinced. He wrote: "I kept exploring, in a manner of speaking, looking especially into such corners as others had neglected."[208] Five years later, when Ley eventually came of age to attend a university, his path was still somewhat murky, yet his ambitions were clear. In one account, he remembered, "By the time I was ready to graduate from high school I was sure that I would become a geologist and I planned my studies accordingly."[209] In a different account, he recalled, "To tell the truth: the border lines of those sciences interested me more than the actual material. I found the history of zoology more fascinating than zoology itself."[210] He also recalled his constantly shifting interests, stating, "I didn't know what I wanted to be. I read omnivorously, and my interests turned to science."[211]

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[207] Ley, *Exotic Zoology*, vii.
[208] Ibid.
[209] "Ley, Willy," *Twentieth Century Authors First Supplement*, 580.
[210] Willy Ley, "The End of the Rocket Society, Part 1." *Astounding Science Fiction*, August 1943, 67.
[211] Bernice Cornell, "More Information, Please!" *Writers' Markets and Methods*, February 1942, 7

Near the completion of his primary schooling, Ley moved to Königsberg, where his father now operated a liquor business. Ley may have moved into his father's house.[212] Only one fact about his time in Königsberg can be verified.[213] That is, he became deeply fascinated by the "local phenomenon" of amber.[214] He spent much time researching the myths, legends, and known scientific facts about its origins. It was a geological mystery that demanded a resolution. Thus, Königsberg was the perfect site for an aspiring young geologist, fossil hunter, and gem digger. Ley began to study at the University of Königsberg.[215] He was confident of his future potential in the realm of science. He was eager to study at a university. He was more determined to embark upon a "lifetime of interest, a lifetime of collecting material, a lifetime of 'exploring.'"[216]

Unfortunately, the year was 1923. Ley's dreams had to confront the political and economic realities of a world upside-down.

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[212] In an autobiographical interview, Ley stated, "By the time I was ready to graduate… my father had meanwhile returned from the Isle of Man… I went to Königsberg to study…" See "Ley, Willy," *Twentieth Century Authors First Supplement*, 580

[213] Sam Moskowitz told the following story: When Ley "suggested that the family send him to college, the idea was greeted with a sense of shock… he would be stepping out of his class, by aspiring to an education greater than that of his father! Greatly troubled, Willy's grandfather on his mother's side sought spiritual guidance from his pastor on this problem. Piously restraining his laughter, the pastor solemnly contemplated the dilemma, and at last gave Willy his blessing." See Moskowitz, "Willy Ley: Forgotten Prophet of the Space Age," *Fantasy Review* 99 (March, 1987): 14. The source of this information is unknown, and the story is doubtful.

[214] "Ley, Willy," *Twentieth Century Authors First Supplement*, 580. The first chapters of his later 1951 book, *Dragons in Amber*, reflect his experience and research while living "in the Samland," where he obtained a necklace that later traveled with him to the United States. See Willy Ley, *Dragons*, 4, 12.

[215] This detail has been difficult to verify. Many biographies, press introductions, and publicity materials claim that he attended, studied at, or even "received degrees" at both the University of Königsberg and the University of Berlin. Most likely, Ley very briefly attended the University of Königsberg in the fall of 1923 and possibly the Spring of 1924, before moving back to Berlin.

[216] Ley, *Exotic Zoology*, viii.

Chapter 2: From the Earth to the Moon, via Berlin

By exploring Willy Ley's formative years in Berlin, we gain a more complex understanding of the style, tactics, and strategies of a science writer and scientific publicist. His actions and words also reveal the joint causes of popularization and scientific internationalism. This shared commitment began with efforts to act as an intermediary between specialists and the public. On the one hand, Ley worked to translate scientific ideas for laypersons, in order to generate support for a scientific cause. On the other hand, he tried to facilitate cooperation and communication among German-speaking scientists, engineers, and enthusiasts. He sought to bring the specialists together. Although the unification of the German-speaking community fit well with nationalistic sentiment, Ley viewed the scene in terms of internationalism that transcended nation states. Over time, he broadened his focus to position himself as a key intermediary between the German-speaking world and foreign theorists and engineers. This belief began to surface in subtle ways during the late 1920s, when he acted as both a coordinator and a publicist. As Neufeld described, Ley became a key player in "a larger international movement that included Russians, Frenchmen, Americans, and Britons."[217]

Ley believed that a scientific "movement" must be open to all, especially the broader public. In this regard, the flourishing of Weimar consumer culture deeply influenced Ley's perception of the role of the public and the potential of a science writer. His first encounter with a fairly popular book shaped his views of the scene, in which a science writer could both make an income through popularization and widely

[217] Michael J. Neufeld, "Weimar Culture and Futuristic Technology: The Rocketry and Spaceflight Fad in Germany, 1923-1933," *Technology and Culture* 31 (October 1990): 727.

influence a cosmopolitan audience through books, newspapers, and lectures. Ley grew to firmly believe that, in the context of scientific internationalism, a public following could support and even finance scientific and engineering breakthroughs, if intermediaries could succeed in bringing exciting information to the people. In this sense, popularization could be the engine that fueled technological innovation. A broader audience could become an influential patron, by funding a scientific organization through donations, membership dues, and the consumption of information in journals, magazines, newspapers, and even newsletters. They could also help the cause through the consumption of other science-related media, especially science fiction books and movies.

These convictions shaped Ley's personality and identity, particularly when he contrasted his own role as a science writer to his perceptions of both specialists and "dangerous" popularizers. His goals as a science writer became shaped by his perceptions of key individuals who represented different extremes. Ley embraced a middle ground between the isolated scientist and the professional charlatan. He would become a responsible intermediary between science and the public. Through his skills as a writer and publicist, he would bring science to the people in a responsible, yet exciting way. By doing so, he would affect the shape of things to come. His style, tactics, and strategies can reveal much about the shared histories of science and media. They also reveal how his emerging identity as a popularizer related to a broader cosmopolitan and media-driven world of Berlin, particularly during the years of economic stabilization.

A Kind of Madness

When Ley turned 17 in October 1923, political and financial instability had peaked. Historian Mary Fulbrook described the scene:

> By August 1923, bank notes were being simply stamped over to increase their value by thousands; payments were being made by the wagon-load, and money became effectively worthless. Millions of people found themselves in severe difficulties or financial ruin, particularly those on fixed incomes (such as pensions) and many of the self-employed and lower middle classes… The general outcome was a widespread total loss of confidence in the Republic, fear and panic, and a wave of strikes and riots.[218]

Author Otto Friedrich later described the situation as "a kind of madness," in which the value of the German mark plummeted, particularly after the French occupation of the Ruhr.[219] By late summer of 1923, 1 million German marks valued 1 American dollar. Friedrich summarized:

> By the middle of 1923, the whole of Germany had become delirious. Whoever had a job got paid every day, usually at noon, and then ran to the nearest store, with a sack full of banknotes, to buy anything he could get, at any price. In their frenzy, people paid millions and even billions of marks for cookoo clocks, shoes that didn't fit, anything that could be traded for something else.[220]

Ley later recalled, "you paid 30,000 marks to ride to work on the street car, and 50,000 to ride home in the evening."[221]

Like most families, the Leys had a difficult time throughout 1923 and even throughout 1924, in spite of economic stabilization. Foremost, Julius Ley's liquor business failed, due indirectly to inflation. This failure eliminated any possibility of financial support for young Willy and his aspirations to become an explorer. By early

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[218] Mary Fulbrook, *A Concise History of Germany*, second edition (Cambridge: Cambridge University Press, 1991), 166.
[219] Otto Friedrich, *Before the Deluge: A Portrait of Berlin in the 1920s* (New York: Harper Perennial, 1972), 123-124.
[220] Ibid., 124.
[221] Cornell, "More Information, Please!" *Writers' Markets*, 7. Ley incorrectly remembered this year as 1922.

1924, Ley had moved back to Berlin to find work while studying part time. Some accounts give the impression that he became a full-time student during these years. For example, Sam Moskowitz claimed, "Ley entered the University of Berlin in 1924, taking courses in paleontology, zoology, comparative anatomy, physics, astronomy, and anatomy. The financing was eased by Ley's apprenticeship as a bank clerk for two and one-half years."[222] This account may be plausible, yet it is important to note that Ley's studies were intermittent, due to various interruptions. "I was a young man," he admitted, "wrestling a living from a kind of permanent economic depression and studying zoology, some paleontology and a little astronomy at night, the typical poor working student of that period."[223] In a different interview, he remembered, "To stay in school I had to work, and became a bookkeeper in a bank, attending school evenings."[224] As statistics have shown, Ley's situation was far from unique, after the percentage of working students rose dramatically in the early 1920s.[225]

Ley's most intense periods of study may have been independent of university courses, as he used public libraries and books for self-education. This point is important, because it highlights how Ley's scientific education often happened outside of state-directed educational institutions.[226] For the most part, he was self-taught in science. He had little respect for his teachers. He also had very little patience for an expert lecturer. Instead, he adventured through libraries, museums, and zoological

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[222] Moskowitz, "The Willy Ley Story," 32.
[223] Ley, Willy, "End of the Rocket Society, part 1," 67.
[224] Cornell, "More Information," 7.
[225] According to Michael H. Kater, the percentage of "work students" rose from 7.2% in 1921-1922 to 49.8% (and 65% for engineering schools) in the fall of 1923. This figure greatly decreased during the stabilization period. See Michael H. Kater, "The Work Student: A Socio-Economic Phenomenon of Early Weimar Germany," *Journal of Contemporary History* 10 (1975): 73
[226] Andreas Daum is correct to point out how our understanding of the non-university realms of science flourished in German civic culture. See Daum, "Science, Politics, and Religion: Humboldtian Thinking and the Transformation of Civil Society, 1830-1870," *Osiris* 17 (2002): 115.

gardens, always with eye out for oddities, overlooked facts, and lost gems of knowledge. In this sense, Ley occupied the non-academic space of an emerging dichotomy. As Daum explains, when "the natural sciences themselves were in the process of becoming institutionalized [in the late nineteenth century] and still facing opposition as a field of instruction," natural history increasingly denoted a realm of amateurs, naturalists, and the general non-specialized public. Daum continues:

> The dichotomy between a (more popular) natural history and the (more academic) natural sciences helped widen the gap between the popularizers of science in Germany and university scientists who did not necessarily dismiss a broader concept of education, but pursued the latter on the basis of their own empirical and specialized scientific research and from a more secure position within civil society.[227]

By the 1920s, this dichotomy had hardened into strict lines of demarcation between the scientist and the non-scientist. Ley belonged firmly on the non-specialized side of this dichotomy, in spite of his intermittent university studies. His training came from his consumption of books and media. He was, in this regard, a product of the cumulative efforts of early science popularizers, public educators, and associations who "pioneered science journalism and created a print market that rapidly expanded…"[228] Like other Germans in the early twentieth century, he could chose from a "dense array of general natural history magazines, specialized journals for amateur scientists, and popular technological journals."[229]

He also learned about science at sites that blended scientific curiosities, the political values of the middle class, and a spiritual or experiential appreciation of

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[227] Daum, "Science, Politics, and Religion," 122.
[228] Ibid., 130.
[229] Daum, 131. Much more work needs to be done to see how these publications were impacted by the Great War. It may be a story of continuity, or it may be a story of decline and recovery during the Weimar years.

Nature. His sites of learning were not places of "disenchantment of the world." Rather, he adopted Humboldtian views, which would be expressed in later works. Ley appreciated Humboldt's attempt to "comprehend the phenomena of physical objects in their general connection, and to represent nature as one great whole, moved and animated by internal forces."[230] Humboldt had blended nature and art, along with science and poetry. Ley's favorite science writers had followed in Humboldt's footsteps. They harmonized various disciplines into a unified whole. They embraced enchantment. The study of nature could be a spiritually fulfilling endeavor. They illustrated, in the words of Daum, how science "could also represent a cultural field that produced new strategies of reenchantment aiming at a harmonious picture of nature, accessible to and acceptable by diverse strands of society, including conservatives and churchgoers."[231] Daum added: "Modernity, in other words, becomes more ambiguous."[232]

This search for wholeness was not confined to the popular realm. Indeed, as historian Anne Harrington shows in *Reenchanted Science: Holism in German Culture from Wilhelm to Hitler*, many German-speaking scientists (particularly in biology and psychology) championed "an ethically and existentially meaningful picture of human existence" that was compatible with modern science.[233] Harrington argued: "Under the banner of Wholeness, these scientists argued, in varying ways, that a transformed biology and psychology—one that viewed phenomena less atomistically and more

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[230] Alexander von Humboldt, *Kosmos: Entwurf einer physischen Weltbeschreibung* (Stuttgart und Tübingen: Cotta, 1845-1862), quoted in Daum, "Science, Politics, and Religion," 119.
[231] Daum, "Science, Politics, and Religion," 137.
[232] Ibid.
[233] Anne Harrington, *Reenchanted Science: Holism in German Culture from Wilhelm to Hitler* (Princeton: Princeton University Press, 1996), xvi.

'holistically,' less mechanistically and more 'intuitively'—could lead to the rediscovery of a nurturing relationship with the natural world."[234] Several of these scientific thinkers also reworked their interpretations of Immanuel Kant to stress that sheer mechanism cannot explain living processes. One could simply not understand how a part functioned without starting with "the organization and needs of the whole."[235] Harrington further explored many of the different ways in which anti-mechanistic discourse overlapped with political and cultural debates, such as the distinction between *Gemeinshaft* (community) and the more individualistic *Gesellshaft* (society). By the Weimar years, much of the rhetoric grew ugly and reactionary. For example, Harrington sees very direct links between anti-mechanism and anti-materialism. She wrote:

> For a while, the intellectual field of holistic life and mind science was able to accommodate a range of political solutions to the tensions between modernity and nostalgia, mechanism and wholeness, science and spirit, *Technik* and *Kultur*. Nevertheless, as intellectuals in the 1920s descended into greater depths of discontent, aspects of the scientific Wholeness/Mechanism oppositional imagery began to take on dimensions that both German-speaking central Europe and the rest of the world would learn to regret. Jews would be increasingly identified as both cause and as flesh-and-blood instantiation of all the worst values of the machine—summative, nonsynthetic thought, soulless, mechanistic science, rootless, mercenary social relations.[236]

There are no indications that Ley thought along these terms. He simply loved science. He enjoyed the way science writers communicated a meaningful wholeness in nature. He loved the way holism mixed genres.

Window-Shopping for a World of Tomorrow

[234] Ibid.
[235] Ibid., xvii
[236] Ibid., xx.

Berlin, October, 1925. On a cold day, Willy took a walk down Berlin's Friedrichstraße, famous for its storefronts, posh real estate, and tourist attractions. He had just turned nineteen years old. The location must have been a sight to see, as some consumers were window-shopping again. Berlin continued to recover from the postwar social, economic, and political chaos. Since the election of Hindenburg, the streets had become somewhat safer. Some Berliners had disposable income. Food was no longer "both a currency and an obsession."[237] Friedrichstraße buzzed as consumers and commuters familiarized themselves with new commodities and advertisements, often covered by vibrant and sometimes controversial "surfaces" of Weimar modernity that imparted Dadaism, futurism, and other avant-garde movements.[238] In years to come, Friedrichstraße would be seen as a "center of life" rather than a simple transportation depot, according to commentator Siegfried Kracauer.[239]

1925 was an exciting year for an observant Berliner like Ley. Not only had the Weimar scene liberated many of the modernist movements from the shackles of Wilhelmine traditionalism and militarism, but also the scene grew increasingly international and cosmopolitan in style. Historian Peter Gay famously wrote:

> Just as the Weimar style was older than the Weimar Republic, so was it larger than Germany. Both in the Empire and in the Republic, German painters, poets, playwrights, psychologists, philosophers, composers, architects, even humorists were engaged in a free international commerce of ideas; they were part of a Western community on which they drew and which, in turn, they fed; chauvinism was not merely offensive to the Weimar style, it would have been fatal.[240]

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[237] Otto Friedrich, *Before the Deluge*, 125.
[238] Janet Ward, *Weimar Surfaces: Urban Visual Culture in 1920s Germany* (Berkeley, Los Angeles, and London: University of California Press, 2001).
[239] Quoted and referenced in Andrew J. Webber, *Berlin in the Twentieth Century* (Cambridge: Cambridge University Press, 2008). Original source: Siegfried Kracauer, 'Lokomotive über der Friedrichstraße', *Schriften*, vol. v.iii, ed. Inka Mülder-Bach (Frankfurt am Main: Suhrkamp, 1990), 194-195.
[240] Peter Gay, *Weimar Culture: The Outsider as Insider* (New York and London: W. W. Norton and Co., 1968), 6.

It was a time of great experiments, from the grand political trial of democracy to the flourishing of expressionist art, quantum physics, and Freudian psychoanalysis. Many cultural "rebels" sought answers to questions surrounding "the need for man's renewal," and they often "turned to whatever help they could find, wherever they could find it."[241] They displayed little respect for frontiers or boundaries.[242] Their "unself-conscious internationalism… shared the vitality of other cultural movements in European history."[243] Their expressionism and their Americanism left marks upon the Berlin landscape.[244] The city was abuzz with strange ideas, foreign imports, passionate politics, and international theories. The media landscape also promoted unconventional ideas and representations of class, gender, and sexuality. Berliners and the press continued to characterize the city as a "Babel of contesting voices and intentions."[245]

The city was also abuzz with new machines. Not only did automobiles and public transportation continue to revolutionize how Berliners commuted, but also the adoption of Fordist or Taylorist techniques of mass production revolutionized how they worked and what they consumed. This explosion of new technologies and techniques has led some historians to generalize. According to Richard Vinen, "The aftermath of the First World War saw the birth of a culture that revolved around machines."[246] Vinen

[241] Ibid., 7.
[242] Ibid., 8.
[243] Ibid.
[244] See, for example, Thomas J. Saunders, *Hollywood in Berlin: American Cinema and Weimar Germany* (Berkeley: University of California Press, 1994). Saunders presents a complex and contested portrait of contemporary reactions of critics. In particular, he illustrates the popularity of American slapstick comedy.
[245] Peter Fritzsche, *Reading Berlin, 1900* (Cambridge and London: Harvard University Press, 1996), 3.
[246] Vinen, *History in Fragments*, 151.

also argued, "In no other period of the twentieth century did educated Europeans talk so much about the impact of science on their lives."[247]

Although much of this public obsession and enthusiasm surrounded new consumer goods and the automobile, a large degree of popular excitement centered on technologies of flight. Apart from the continuation of amateur gliding, 1925 marked the creation of the Luft Hansa airline. The transoceanic flights of the ZR III continued to dazzle and amaze. Germany was buzzing with "airmindedness" surrounding the technologies of flight. In the coming years, Germans would gather in crowds to witness aerial spectacles or a passing Zeppelin. For historian Peter Fritzsche, much of this public enthusiasm can be linked to German nationalism, because aviation "forecast a new, more powerful, and disciplined German Reich that would be able to meet the hard disciplined demands and join the revived imperial contests of the twentieth century."[248] In this view, an expression of aerial enthusiasm was a deeply political act. He argued, "Weimar Germans gathered around airplanes and pilots as much as they crowded socialist picnics and nationalist parades."[249] He added, "Machine dreams mingled with national dreams. In an increasing technological century, Germany appeared to hold its own, despite political and economic hardships. Between the two World Wars, it was aviation who took the measure of progress."[250]

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[247] Ibid., 171. One could easily contrast this statement to Nick Hopwood's "Producing a Socialist Popular Science in the Weimar Republic," in *History Workshop Journal* 41 (1996): 117-153. Hopwood argued, "After the First World War… public interest in science fell, and many who had nurtured a positive image of scientific progress now associated the sciences with poison gas." He added, "Among the educated middle class, hostility to science was rife, and scientists felt a sharp loss of authority." See Hopwood, 118.
[248] Peter Fritzsche, *A Nation of Fliers*, 134.
[249] Ibid., 135.
[250] Ibid., 137.

Ley would have agreed with the last sentence. Technologies of flight were technologies of the future. They fascinated him deeply. Like other Germans, Ley probably took every opportunity to marvel at airplanes and airships, which were still sights to behold in 1925. Perhaps as he walked the streets of Berlin, he paused and looked up every time something buzzed. So too did fellow pedestrians who were seeing airplanes for the first time, outside of the pages of newspapers or magazines. Yet, unlike many Germans who may fit with Fritzsche's description of "airmindednesss," Ley most likely did not fantasize about the revival of a German empire. The airplane was an international symbol for the conquest of the air. Like other Germans, Ley looked to the future.

In 1925, as Ley strolled down Friedrichstraße, his direction was clear. The economic and political situation was stabilizing. His studies were slowly progressing, and he was preparing for examinations.[251] He was on his way to becoming a practicing scientist. During this period, he had become increasingly fascinated with magnitude of time and the age of the earth. His interest in geology grew stronger. In a later interview, he recalled, "My intention was to become a practicing geologist. A young man, of course, never knows what he's going to be and he is never as definite as his answers indicate. But it was geology, then."[252] He had little ambition to become a writer, despite his love of popular science books. Nevertheless, he was pleasantly surprised by a check in the mail. He later stated, "My first check was unexpected. I wrote to a newspaper correcting a scientific inaccuracy in a published article. The editor printed the correction

[251] Harvey Breit, "Talk with Willy Ley," *New York Times*, July 22, 1951, I56. Ley stated, "Just when I was ready to prepare for examinations… I came across a book by a Prof. Hermann Oberth in 1925."
[252] Breit, "Talk with Willy Ley," I56.

and sent me a check."[253] Although it is unclear when he received that check, Ley had a few Rentenmark to spare, as he window-shopped for a good book.

This type of window-shopping was not new for many Berliners like Ley. Turn-of-the-century Germans had taken stock of a rapidly changing metropolis, which invited new behaviors of "errant consumption, flipping through, browsing over, looking past."[254] At the same time, according to Peter Fritzsche, "The popular press introduced Berlin as a city of windows, in the first instance of marvelous commercial display windows, but also a place that provided continuous pleasure if viewed through the newspaper's front-page 'window.'"[255] Yet, something distinctly new and exciting was beginning to happen to the storefront windows during the Weimar years. As scholar Janet Ward summarized: "Indeed, in the stabilization years, 1924 to 1929, Weimar commodity display was at its zenith, both in relation to avant-garde design and in its ability to engender the desire to buy in the passing consumer."[256] Ward continued: "The store window, in particular, as the primary *mise-en-scène* of the designs and desires of Weimar consumerism, was host to daily (and especially nightly) acts of seduction that occurred on the city street."[257]

As with much of the German experience with modernity, these surfaces and spaces could be shocking. As Andreas Killen notes in *Berlin Electropolis: Shock, Nerves, and German Modernity*, "Berlin experienced more intensely than any other city

[253] Cornell, "More Information," 7. A mysterious statement follows this comment: "The next writing, a novel, really was a criticism too. Several current novels were inaccurate scientifically, and I wanted to do one that was not contrary to accepted natural laws… It was published—and that is all I can say for it." Unless there is an undiscovered work, Ley's first novel was *Die Starfield Company*, which was written several years later, most likely in the Fall of 1928.
[254] Fritzshe, *Reading Berlin, 1900*, 129.
[255] Ibid., 154.
[256] Ward, *Weimar Surfaces*, 197.
[257] Ibid.

the changes that swept western European society over the second half of the nineteenth century."[258] By 1900, it was unrecognizable as the Berlin of 1870. As an electropolis, it was "arguably the most modern city in Europe."[259] Indeed, it became not only "a physical staging ground for Germany's modernization, but also… a virtual persona… within the larger drama of the modernizing process, alive with energies and currents both exciting and destructive."[260] By 1924, the scene was dazzling and dizzying, full of wonder, shock, awe, and the technological sublime. Many Germans sought social regeneration in Americanism. As Killen wrote: "The enthusiasm for all things American that overtook postwar Germany encompassed mass culture, domestic appliances, and architecture, but above all rationalization in the workplace: Taylorism, Fordism, and psychotechnics."[261] Killen added, "Berlin's technological and cultural brilliance during the 1920s seemed to realize the promise of the electrified phantasmagoria conjured up by the Trade Exhibition of 1896."[262] As Ley roamed the streets of Berlin, he most likely marveled at the "advertising techniques aimed to shock the passerby, conducting a form of 'technological war on the senses' that suggested continuities between the war and postwar urban experience." Berlin was a city of "hypermodern urbanity… tinged with fever, a hothouse of unreality."

Suddenly, Ley saw a book cover that peaked his interest. "I paused at a bookstore window to see on display (translated from German): *The Advance into Space—A Technological Possibility*, by Max Valier, a writer of whom I had heard

[258] Andreas Killen, *Berlin Electropolis: Shock, Nerves, and German Modernity* (Berkeley, Los Angeles, and London: University of California Press), 8.
[259] Ibid., 8.
[260] Ibid., 9.
[261] Ibid., 182.
[262] Ibid., 184-5. The next two quotes can be found on the same pages.

vaguely."[263] The cover of the book depicted a space ship en route to Saturn. Ley remembered:

> Normally near-broke, as one was in those depression times, I luckily had enough money to purchase the book. The proprietor warned me it was "not an adventure story" (the term "science fiction" had not yet been invented) but a technical work. He was right. It was what we would call now a "feasibility study" of the concept of space travel by means of rockets.[264]

"As far as I am concerned," Ley recalled, "the Space Age began…"[265]

The Investigation of Sources

This incident marked Ley's first encounter with a contemporary popularizer of spaceflight who had achieved some degree of fame. Ley also learned that Valier was a "self-proclaimed astronomer," who made an income through traveling lecture tours. Despite Germany's economic and political difficulties, Valier had gained an audience, and his futuristic book on space travel sold well. Many Germans were growing increasingly fascinated by a futuristic idea, which Valier promoted enthusiastically.

To Ley's surprise, Valier's book contained few original ideas. Instead, *The Advance into Space* simply popularized the theories of a "professor" named Hermann Oberth.[266] All credit went to Oberth's *Die Rakete zu den Planetenräumen* (*The Rocket Into Interplanetary Space*).[267] Ley had not heard of this professor, but he recalled what followed: "Intrigued—and with no inkling of how this would change my life—I soon saved enough to buy Oberth's own book. The clerk cannily showed me a similar book

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[263] Ley, "How It All Began," 23. See also, Max Valier, *Der Vorstoss in den Weltenraum: eine wissenshaftlich-gemeinverständliche Betractung* (München und Berlin: R. Oldenbourg, 1925).
[264] Ley, "How It All Began," 23.
[265] Ibid.
[266] Neufeld, *The Rocket and the Reich*, 7.
[267] Oberth, Hermann, *Die Rakete zu den Planetenräumen* (München: R. Oldenbourg, 1923).

by Dr. Walter Hohmann—*The Attainability of Celestial Bodies*. I bought both at the penalty of being so broke I had to walk home, some three and a half miles."[268] When Ley finally arrived at home, he eagerly dove into the books, only to discover just how difficult and inaccessible they were. He recalled, "Opening them, I got a shock—both books were almost incomprehensible!" Despite his scientific training, "the principles developed in those books were just barely understandable." "And the equations!" Ley exclaimed, "Those of Oberth, a brilliant mathematician, were worse than Hohmann's, who, as an engineer, dealt in less lofty realms."[269] On Oberth's book, in particular, "As far as the general, even the interested, public was concerned, the book might just as well have been printed in Sumerian characters."[270] Only one section of the book could be read "without getting caught in the barbed wire of equations every two seconds."[271] Yet, Ley remained undeterred: "I studied the book over and over until it made sense."[272]

The core ideas of Oberth's self-published doctoral thesis excited Ley to no end, for it attempted to prove four assertions: (1) "With the present state of science and technology it is possible to construct machines that can climb higher than the earth's atmosphere"; (2) "With further development" it would be possible to escape the gravity of the earth; (3) These machines could transport a human into space without inherent harm; (4) This technological accomplishment could both pay for itself and happen in the coming decades. Oberth also ruminated on the military potential of spaceflight

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[268] Ley, "How It All Began," 23.
[269] Ibid..
[270] Ley, *Rockets* (1944), 106.
[271] Ibid. Wernher von Braun later conferred: "It was gibberish." Quoted in Michael J. Neufeld, *Von Braun: Dreamer of Space, Engineer of War* (New York: Vintage Books, 2007), 24. It should be noted this article was ghostwritten: Wernher von Braun, "Space Man—the Story of My Life," *American Weekly*, July 20, 1958, 12, 14-16.
[272] Ley, "How It All Began," 24.

technologies, such as a giant space mirror that could be used to redirect and concentrate sunlight to destroy enemy cities.[273]

When Ley worked through the dense sets of calculations, he became convinced that Oberth was the "father" of an emerging field that opened up a new frontier of scientific exploration. Ley also credited Hohmann's book as a "monumental classic" in this emerging field, because it contained "the first tables of satellite orbits, planetary trajectories and re-entry 'corridors' through the atmosphere."[274] After the young Ley discovered the merits of these books, he then discovered why Valier's book was gathering a small following. At the time, "there was clearly need for some understandable writing."[275] Valier had taken the incompressible and attempted to translate it for a broader audience. He attempted to extract the core theoretical discoveries to excite the German public to envision a future of rockets and interplanetary travel. Despite the initial doom and gloom of the postwar years, many Germans still held out hope for science and technology. Valier profited from such hope.

Ley must have admired Valier's early success in this regard. Yet, in other aspects, Ley almost immediately resented and disliked both Valier's work and his public persona. While re-reading Valier's *The Advance into Space*, Ley found that many of the concepts had been mistranslated, mangled, or sloppily presented. Ley recalled:

> Valier's book… failed to be what the author had promised. It was full of well-meant but ridiculous illustrations. When it came to difficult points, Valier resorted to flippancy which he took to be humor. A great deal of the book was in fine print ('to be skipped by the lay reader'), full of calculations, most of them made by Oberth. In spite of all of these faults it sold at a fair and steady rate…[276]

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[273] See Barth, *Hermann Oberth: Vater der Raumfahrt: autorisierte Biographie* (Esslingen: Bechtle, 1991), 73-78 (as referenced by Neufeld, *Von Braun*, 24.)
[274] Ley, "How It All Began," footnote, 23.
[275] Ley, *Rockets* (1944), 110.
[276] Ley, *Rockets, Missiles, and Space Travel* (New York: Viking, 1958), 116

The "poor quality" of Valier's popularization inspired Ley "to enter into competition with him." Ley explained: "With the enthusiasm peculiar to that age [of 19] I decided that I could do better than Valier."[277] Not only would Ley attempt to translate the complicated equations of Oberth, but he would also "simplify Valier's book in turn."[278] This endeavor to translate the ideas of a specialist into ordinary and understandable language was the beginning a scientific writing career. It was also how Ley learned science and history, when he could not focus on university studies. Overall, this first endeavor highlighted a methodology of self-teaching that remained with him for the rest of his life. Without little formal training in the finer points of a scientific or academic discipline, Ley would later dive into specialized texts, complex diagrams, mathematical equations, and primary historical sources. Often, he discovered that, beneath the complex mathematics, scientific language, or dense prose lay a very simple and understandable idea.

Oberth had written a dull and overly complicated book. He bullied the intelligent non-specialist. Foremost, he did little to advance his cause in the public sphere. In Ley's view, Oberth's tactics reflected sheer scientific snobbery. As he later recalled: "No scientific fact or theme is too difficult to be explained to the intelligent outsider. If somebody says that this or that cannot be explained to the layman I understand this to mean that this person either does not have enough factual knowledge or else insufficient skill as an interpreter; often both."[279] Oberth lacked the skill of communication. Valier lacked the scientific understanding. Therefore, Ley would do

[277] Ibid.
[278] Ley, "End of the Rocket Society, part 1," 67.
[279] "Ley, Willy," *Twentieth Century Authors First Supplement*, 580.

what neither could do sufficiently. He would gut out the confusing diagrams and replace the equations with words. He would unmask the science and expose it to public scrutiny. He would bring Oberth's vision of cosmic travel to the people.

Journey to the Cosmos

Ley's quest to write a "small and formula-free" book of popular science produced *Die Fahrt ins Weltall* (*Journey to the Cosmos*), a 68 page treatise published by Hachmeister & Thal in 1926.[280] In unimposing language, Ley discussed the possibility of life in empty space and the survivability of men on other worlds. He then outlined the dangers and "enemies" of spaceflight, as well as the fundamentals of rockets and the physics of space travel. While relentlessly promoting the ideas of Oberth, the book culminated in a comparison of Oberth and his American counterpart, Dr. Robert H. Goddard, whose 1919 *A Method of Reaching Extreme Altitudes* had circulated in Germany.[281] It seems clear from the text that Ley was getting his information about Goddard from Oberth's appendix, while associating Goddard with powder rockets. The book makes the case that liquid fuels are clearly the next step forward. Oberth's ideas paved the way for a future of cosmic exploration. The direction of Goddard's research led nowhere.

While reading Ley's first book in hindsight, it is easy view Ley as a spaceflight advocate who, like others at the time, "grossly underestimated the complexity and difficulty of the technology."[282] He was quite optimistic that existing technologies and

[280] Willy Ley, *Die Fahrt ins Weltall* (Leipzig: Hachmeister and Thal, 1926).
[281] In a 1935 letter to G. Edward Pendray, Ley claimed to have read Goddard's book in Germany. He later claimed to have not read it.
[282] Neufeld, *The Rocket and the Reich*, 10.

techniques could be improved to launch a spaceship, given further engineering progress with liquid rocket fuels. At the same time, he minimized the "enemies" of velocity, meteorites, and radiation. To be sure, the dangers were ever-present, but they were obstacles that could be overcome with relative ease. The book then concluded with a prophecy. When the first rockets escape the Earth's atmosphere, "mankind, which physically and spiritually reigns upon the Earth, has taken a new step into a new age… THE AGE OF THE CONQUEST OF SPACE."[283]

Ley's *Die Fahrt* was not a popular success, compared to Valier's earlier and later books. But, the book did sell nearly 1000 copies per year between 1926 and 1932. "To my surprise," Ley wrote, "many people, including Oberth, said that it was actually better than Valier's—at any event it did what Valier failed to do, it told the whole story understandably and in as few words as possible."[284] That it did not sell as well as Valier's book did not particularly upset Ley. It established his credibility among many disparate individuals who were interested in rocketry. It also established Ley as a competent popularizer. Despite those successes, Ley still did not commit himself to becoming a science writer: "[E]ven after having done my version of Oberth's book, I did not think my future would be in such writing. I planned as before to become a paleontologist, or perhaps an astronomer. But I had no taste for engineering, and I only toyed with the idea of becoming a writer."[285] He also later admitted that even his desire

[283] Ley, *Die Fahrt ins Weltall*, 68. In the original text, the passage reads with spacing emphasis, not capital letters.
[284] Ley, *Rockets* (1958), 116. According to Moskowitz, "He got an advance of $110 from Hachmeister & Thal, Leipzig, who published it in 1926… priced at the equivalent of 30c." See "The Willy Ley Story," in *Worlds of Tomorrow* (May, 1966), 33. Moskowitz's source is unclear.
[285] Ley, *Rockets* (1958), 24.

to become a scientist felt rather directionless, yet still connected by a central quest to become an explorer:

> To tell the truth: the border lines of those sciences interested more than the actual material. I found the history of zoology more fascinating than zoology itself, and all through the astronomical lectures I wondered about Svante Arrhenius' theory of living spores traveling through space. If one could only go to other planets and check on that theory. But propellers do not bite in a vacuum and gravityless substances violated half a dozen well-established laws of physics.[286]

"Do you see," he asked, "how the books by Oberth and Valier fitted in?"[287]

The Museum of Mars

In the Fall of 1926, as Ley reviewed corrections to *Die Fahrt*, a friend told him of a Mars exhibit, held soon at the observatory of Treptow (Berlin).[288] Ley went with friends to view telescopic photographs of Mars, as well as browse the literature for sale. Ley remarked that how similar were the museum of Mars on Earth and the "Museum of Earth" on Mars, as depicted in Lasswitz' *Auf Zwei Planeten*.

Soon afterward, Ley wrote a "supplement" to *Die Fahrt ins Weltall* called *Mars, der Kriegsplanet*. It would serve as an "understandable description of the results to date of astronomical research about the neighboring planet."[289] Not only did Ley casually recount the history of astronomical discoveries and theories, but also he outlined the recent controversies over "canals." In many ways, the book was a sequel to *Die Fahrt*. "In the first part [of *Die Fahrt*]," Ley wrote, "I showed that it would be possible for people to live on an alien world for a brief or extended period. Then, in parts II and III, I

[286] Ley, "The End of the Rocket Society, part 1," 67-68.
[287] Ibid., 68.
[288] Willy Ley, *Mars, der Kriegsplanet* (Leipzig: Hachmeister and Thal, 1927), 5.
[289] See Ad, *Die Rakete*, May 1929, inside cover.

presented the technical details as to how one could enable people… to reach such strange planets."[290] With this new sequel, Ley "strived to make contemporary knowledge about Mars easily understandable, readable, and accesible for the broadest strata of the population."[291] Ley added his hope that the book would steer the imagination of his readers "in the right direction."[292] He asked the specialists to bear in mind that "this is not a book for astronomers." The intended audience are the visitors of zoological gardens who, amidst enjoyment and relaxation, learn something useful about nature. "One can also do that here," Ley argued.[293] He stated his firm belief that Mars contained some form of life, despite its barren and cold landscape. Thus, he devoted a significant portion of the book to explaining the basics of evolutionary biology.

The book reads as a tour guide for "the museum of Mars" as depicted in both the history of science and the human imagination. It moved from explanations of ancient theories and observations to medieval manuscripts, before Kepler emerged as "the first serious" researcher.[294] The bulk of the text focused on the nineteenth century. Ley spent much time discussing Pickering, Lowell, and the popular obsession with news about the red planet. The question of the "canals" remained a mystery. However, astronomers were certain that darkening areas of Mars indicated vegetation.

The book concluded with a discussion of "Ignorabimus?" Ley discussed the limits of astronomical knowledge, asking, "Will we ever know? Does Mars harbor life?"[295] Ley left the mystery unsolved, while expressing his doubts about earthbound

[290] Ley, *Mars*, 3
[291].Ibid.
[292] Ibid.
[293] Ibid., 4.
[294] Ibid., 9.
[295] Ibid., 52.

astronomy. He also doubted the possibility of communicating with Mars through existing technologies. If the mysteries of Mars are to be solved, then it required a future age of space travel. Ley added that the "rocket ship will unveil [the mysteries] for all of us, achieving what has always been dreamed, yet considered impossible: to carry men to Mars." This trip would discredit "the mocking laughter of certain 'Gebildeter,' who have neither seen the cover of Oberth's book nor know the name of Max Valier."[296] Ley then expressed his high hopes for a society that just formed in Vienna. Experiments would soon begin. If he could infiltrate the inner circle of experimenters, perhaps one day he might be among the next generation of explorers.

A Society for Space Travel

During this period, Ley received a letter from Max Valier, who suggested that a club be formed to finance the rocket experiments of Oberth. Valier asked Ley to contact a man in Breslau by the name of Johannes Winkler, who could make the necessary court applications for a legal charter.[297] Then, Ley met Valier for first time, as one of Valier's lecture tours took him through Berlin. Ley later described his first impressions of Valier as a "kindred soul" whose publicity photos showed a younger Valier with hair, while the man himself "now looked like Yul Brenner."[298] By this point, Ley must have been aware of Valier's more eccentric writings on occult sciences.[299] He may not have

[296] Ibid., 55.
[297] Ley, "How it all Began," 25.
[298] Ibid.
[299][299] See, for example, Max Valier, *Die Sterne Bahn und Wesen: gemeinverständliche Einführung in die Himmelskunde* (Leipzig: R. Voigtländer, 1926). For a biography of Max Valier, see I. Essers, *Max Valier: Ein Vorkämpfer der Weltraumfahrt, 1895-1930* (Düsseldorf: VDI-Verlag, 1968), also available as a NASA technical translation: I. Esssers, *Max Valier: A Pioneer of Space Travel* (Washington: National Aeronautics and Space Administration, 1976).

known about Valier's goal of using rocketry to confirm Hans Hörbiger's theories of glacial cosmogony, but he must have been aware of Valier's more philosophical and metaphysical outlook. Nevertheless, they had a cordial breakfast together, during which Valier mentioned that a Munich professor had lectured about Englishman Congreve's war rockets, developed in the nineteenth century. Ley remembered, "Valier suggested that I might check whether rockets had a use in history other than as mere fireworks… [which was] a fact scarcely suspected before."[300] This challenge intrigued Ley, and his earliest research traced the long history of the rocket as both a firework and a weapon of war. As Ley adventured into Berlin libraries and archives to develop the history of the technology, Valier continued his publicity tours.

The idea of a club soon materialized. The founding meeting of the Verein für Raumschiffahrt (The Society for Space Travel, also called The German Rocket Society) was held in July of 1927.[301] As noted by historian Frank Winter, the VfR eventually became "the most prestigious of all the space travel organizations."[302] The group's ultimate goal was ambitious: "The purpose of the union will be that out of small projects, large spacecraft can be developed which themselves can be ultimately developed by their pilots and sent to the stars."[303] Ley described the goal in less technical language: Their main purpose included "spreading the thought that the planets were within reach of humanity if humanity was only willing to struggle a bit for that goal."[304] Ley also recalled in 1959: "Our sights were set high from the very outset."[305]

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[300] Ley, "How It All Began," 25.
[301] For the rest of his life, Ley incorrectly reported that these events occurred in the month of June. Arguably, this incorrect fact reveals how disconnected Ley was from the founding of the VfR.
[302] Frank Winter, *Prelude to the Space Age: The Rocket Societies, 1924-1940* (Washington: Smithsonian Institution Press, 1983), 15.
[303] Quoted in Winter, 35.
[304] Ley, *Rockets* (1944), 113.

Despite these lofty goals, the group's origins were quite humble. Ley commented in 1940: "The Society had been founded in 1927, mainly as a kind of scientific debating club…"[306] At least nine rocket enthusiasts, including Valier and Winkler, meet in the backroom of a Breslau tavern called the Golden Scepter.[307] Winkler accepted the presidency and his role as an editor of *Die Rakete*, the club's newsletter and "journal." Although Ley was neither present nor listed in the charter, he later insisted that he was a co-founder of the organization, due to his work as an international correspondent.[308] Of course, this title depends on the definition of "founder." What is clear is that Winkler and Valier "agreed that their first task was to assemble all of the names of people known to a—more or less numerous—interested public as space travel enthusiasts."[309] They invited Ley, Oberth, and many others to join the society after its founding. Two months later, it had 400 members who received its newsletter (according to Ley). *Die Rakete* was an interesting mixture of reports, technical articles, and serialized science fiction novels.[310] In some ways, it could be read as a scientific journal, offering detailed accounts of theoretical or mathematical developments in the field. At other times, it either covered sensational rocket stunts or provided a new installment of a science fiction novel by Otto Willi Gail or Max Valier. It even printed poetry and jokes.[311]

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[305] Willy Ley to Wernher von Braun, *The Conquest of Space: A Conversation between Wernher von Braun and Willy Ley*, LP Recording (New York: Vox, 1959), 00:23-00:24.
[306] Willy Ley, "What's Wrong with Rockets?" *Amazing Stories*, March 1940, 49.
[307] Winter, *Prelude*, 35.
[308] Ley would later become defensive about his status as an original founder. In 1961, he wrote: "I was not personally present at the first meeting and was, therefore, not listed in the charter. But I had been active in its formation and, of its original founders, I am the only one now alive [in 1961]. Professor Oberth, Dr. Hohmann, and Dr. von Braun—all alive today—joined the Society later and were not founders." See Ley, "How It All Began," 48.
[309] Ley, "The End of the Rocket Society, part 1," 65.
[310] Marsha Freeman, *How We Got to the Moon: The Story of the German Space Pioneers* (Washington D.C.: 21st Century Science Associates, 1993), 34-35.
[311] Ibid., 35.

For a short period of time, the VfR was successful. "The growth of the VfR was rapid," Ley stated, "Within a year it acquired almost five hundred members, among them everybody who had ever written about the problem in Germany and in neighboring countries."[312] Despite hopes for experiments, the group's initial contributions to the cause of spaceflight lay in the realm of media, not in sites of research and experimentation. As Roger D. Launius notes, "One of its strengths from the beginning… was the VfR's ability to publicize both its activities and the dream of spaceflight."[313] For many historians, not only was Ley a central figure in the creation and growth of this international (although mostly German-speaking) scientific community, but also he was also instrumental in broadening the appeal of their ideas. We can privilege his role as a translator, interpreter, and even "science editor" on a quest to reach out for both an audience and a patron.

Yet, it is important to note that Ley's role in the early days of the VfR has been inflated over time. He was absent from the pages of *Die Rakete* prior to 1928. There is little evidence to suggest that Ley "co-founded" the organization. Despite Ley's later claims, he did not become very active with the VfR until 1928, at the height of rocket stunt publicity. We can only speculate as to why Ley later inflated his connections to the organization in 1927. As for his original views of the society, Ley may have viewed the centrality of Valier with a skeptical eye.

[312] Ley, *Rockets* (1958), 118.
[313] Roger D. Launius, "Prelude to the Space Age," in *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program, Volume 1: Organizing for Exploration*, ed. John M. Logsdon et al. (Washington DC: National Aeronautics and Space Administration, 1995), 9.

One thing seems clear. When Valier and others founded the VfR in 1927, Ley was attempting to reach a wider audience as a science writer on natural history. He was branching out. Rockets were still interesting. But, reptiles were marvelous.

The Book of Dragons

Ley's first "real" book, *Das Drachenbuch* (1927), had nothing to do with rockets or astronomy.[314] In 208 fact-filled pages, Ley explored the natural world of reptiles, amphibians, and other amazing, but misunderstood creatures. Chapters included "The Struggle with the Dragon," "The Basilisk in Legend and Zoology," "The Great Sea Serpent," and "The Survivors of the Australian Bush." Like the earlier books of "Dr. Cell," *Das Drachenbuch* educated and entertained readers, while often debunking myths and unpacking legends. The overall goal of the book was made clear in the forward: "These animals are seen as either disgusting or toxic" by most Berliners.[315] If people would simply see the creatures up-close in the many wonderful aquariums of the city, they would suddenly view them differently. These "strange animals" are "neat."[316]

In the illustrated pages that followed, Ley presented neat facts and strange curiosities. The book also served as a tour guide, with short chapters that taught readers about animals and fossils on display at popular locations. Other chapters, such as "The Great Sea Serpent" encouraged readers to wonder about future discoveries of stranger

[314] Willy Ley, *Das Drachenbuch: Plaudereien von Echsen, Lurchen und Vorweltsauriern* (Leipzig: Thüringer Verlags-Anstalt H. Bartholomäus, 1927).
[315] Ibid., 6.
[316] Ibid.

creatures and other living fossils, which may not be extinct. “Well, everything is possible,” Ley concluded.

Das Drachenbuch is an important book, because it reflected Ley’s evolving writing style, as he mixed scientific explanations with jokes, witticisms, and interesting stories about the people who sighted or discovered these creatures or their remains. It seems clear that he imitated the styles of Bölsche and Zell. His language became playful, especially when referring to “dragons.” Often, terms or characters from fairy tales are inserted into the narrative, while illustrations could be equally playful. Occasionally, Ley offered personal reflections, as if speaking to the reader in a more personal tone.

Although his style of writing about science, nature, and history would evolve in later decades, every key element was present in his first “real” book. His “book of dragons” would educate and entertain. It would debunk myths and combat popular misperceptions. Most notably, it would excite readers about the wonders of the world. The book also used many opportunities to place readers in exotic locations, including the distant past. If only one could venture beyond the borderlines of time, they could see the fascinating and “neat” landscapes of the past. Those landscapes would seem quiet alien and otherworldly. For the explorers, they offered a playground for wonder, awe, and reverence. Ley took his readers along for the ride. They became fellow explorers.

The Possibility of Space Travel

While Ley spent 1927 branching out, he returned to the subject of space travel in 1928, when he edited a book on rockets and spaceflight. During this period, he became

increasingly involved with the VfR. "My plan was about as follows," he wrote, "First, get all the people who had contributed ideas together and make them write a book in collaboration."[317] Unlike engineer Hohmann's mathematical and cryptic treatise, this new book would be "a readable book which would convince a great number of people, not precisely the man in the street, maybe, but engineers, teachers, the higher-ups in the civil service, and so on."[318] Ley truly believed that, if scientists, engineers, theorists, and mathematicians could speak in clear and understandable language, then many other Germans (and Europeans) would become excited about a future of space travel. Consequently, many followers would join the VfR by subscribing to *Die Rakete*. This infusion of funds would further finance the experiments of Oberth. Thus, an enthusiastic audience would help pay for the exploration of a new frontier.

Ley's role as an editor produced *The Possibility of Space Travel: The Understandable Contributions on the Problem of Interplanetary Travel* (*Die Möglichkeit der Weltraumfahrt: allgemeinverständliche Beiträge zum Raumschiffahrtsproblem*, 1928).[319] As seen from the title, the possibility of space travel rested almost entirely on the understandable contributions of scientists and engineers. The book attempted to present those ideas and theories in clearest of possible terms. It included chapters written by most of the notable German-speaking individuals in field, including Oberth. Ley later claimed to have reached out internationally, particularly to Robert H. Goddard in the United States.[320] Ley did not know many of the details surrounding Goddard's current research, but he was aware of Goddard's relevance to

[317] Ley, "The End of the Rocket Society, part 1," 68.
[318] Ibid.
[319] Willy Ley, ed., *Die Möglichkeit der Weltraumfahrt: allgemeinverständliche Beiträge zum Raumschiffahrtsproblem* (Leipzig: Hachmeister and Thal, 1928).
[320] Ibid. There is no evidence of this correspondence in the published papers of Goddard.

the scene. Rumors still circulated about Goddard's ongoing secret activities, which greatly intrigued Ley and others. Unfortunately, Goddard did not reply to the invitation, according to Ley.[321] Nevertheless, Ley's book contained many different contributions from scientists and engineers, who tried to present their ideas to the educated layperson. Ley would later criticize the mixed success of the chapters. Yet, he reminisced in 1943: "I could do better now as an editor, but it was not bad. It even sold well in spite of the high price, the equivalent of five dollars."[322]

While Ley later claimed to have reached out internationally, it is difficult not to read his introduction in its original intent: "My present hope is that the book will help awaken the general interest not only intellectually, but also financially, so that from this German rocket book a German space ship will emerge."[323] Perhaps this publication illustrated some degree of tension between Ley's "scientific internationalism" and his enthusiasm for a "German space ship." Scholars might be tempted to bring in the classic perspective of Paul Forman, who famously argued that "scientific internationalism," as it was voiced in Germany, became a convenient smoke screen for nationalistic science. While scientists were "paying lip service to the ideology of scientific internationalism," they subverted its classical premises.[324] Forman concluded: "if finally we ask what part of the specific vitality of Weimar scientific culture derived from a genuinely internationalist impulse, I think the answer must be: none at all."[325] Ley's subsequent correspondence with interplanetary societies and foreign scientists might be seen as "a

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[321] Ibid.
[322] Ibid.
[323] Translation taken from Freeman, *How We Got to the Moon*, 42. For original text, see Ley, *Die Möglichkeit der Weltraumfahrt*, iii-iv.
[324] Paul Forman, "Scientific Internationalism and the Weimar Physicists: The Ideology and Its Manipulation in Germany after World War 1," *Isis* 64 (June 1973): 152.
[325] Ibid., 180.

supranational agreement on the ground rules."[326] The international nature of the VfR could be seen as an attempt to bolster the prestige of German scientists and engineers, who encouraged a united front of research, in spite of defeat and the loss of national prestige.

Ley did not distinguish between his Austrian and German contributors, which implied that science served as a unifying cultural force. This perspective could be seen as nationalistic. For example, Forman described a widespread sentiment among physical sciences and the *Gelehrten* (learned) who believed that "scientific great-power status could function as a substitute for political great-power status."[327] While their vision of science may not have been focused on the real world "applications" of science through engineering and technology, rocket enthusiasts were looking ahead to a moment when theory would have real world implications, including a German moon landing. As will be discussed in chapter 3, the space ship had a role to play in the rejuvenation of the German empire, at least according to science fiction writers. For Ley and the VfR, a central step in scientific progress involved bringing together and harnessing the collective efforts of the German mind.

Yet, here is where the similarities with Forman's group of physicists end. As Ley became more active with the VfR, his international correspondence greatly increased, particularly after the formation of foreign interplanetary societies. He despised the secrecy of Goddard (and later Oberth). He attempted to disseminate all knowledge throughout the German-speaking world and beyond. His internationalism was not a smoke screen. There was a genuine attempt to share information across

[326] Ibid., 154.
[327] Ibid., 152.

borders. Ley grew eager for international cooperation in the conquest of the next great frontier. Uniting the German-speaking efforts was simply a first step toward a broader international exchange.

Ley had lofty goals in mind when bringing together experts to collaborate and educate the public. He also attempted to make rocketry respectable. Unfortunately, Ley believed that his efforts were sabotaged at the exact moment of publication. Instead of a modest, but respectable degree of public support for rocketry and the VfR, a wave of "colossal nonsense" distracted the public.[328] The man responsible for "the greatest possible misunderstanding and stupidity" was none other than Max Valier.[329]

Germany's "Rocketry Fad."

The years of 1928 and 1929 marked the peak of a "rocketry fad" in Germany.[330] In some ways, this fad was related to the efforts of Ley and other spaceflight advocates. Collectively, they helped to make Germany "the most rocket-minded country."[331] The engineers and popularizers succeeded in exciting many Germans about a future of space travel. From books and articles to lectures and public exhibitions, the spaceflight advocates campaigned actively. Yet, Neufeld is correct to argue, "None of this made a deep impression on the German public or media, however, until the energetic Valier found a wealthy sponsor to fund the demonstrations that he thought were needed to

[328] Ley, *Rockets* (1958), 119.
[329] Ibid.
[330] See, Neufeld, "Weimar Culture and Futuristic Technology," 725-752. See also, Neufeld, "Spaceflight Advocacy from Weimar to Disney," in *1998 National Aerospace Conference Proceedings* (Dayton, Ohio: Wright State University, 1999), 72-76.
[331] Willy Ley, Gallery Proof for *Inside the Orbit of the Earth*, 26.

pave the way for future rocket planes and spaceships."[332] In this regard, the sensationalism was mainly due to "the most influential and colorful of the lot" of spaceflight advocates, not necessarily the cumulative activities of the VfR and other individuals.[333]

Valier had persuaded automobile giant Fritz von Opel to construct and race "rocket cars," which were propelled forward by powder rockets attached to the rear. On May 23rd, 1928, crowds of Germans cheered as Opel's "Rak II" soared around the Avus speedway at 125 miles per hour. Prior to the race, an engineer announced: "Within a few years it will be possible for Berliners to travel across the ocean within five hours—to breakfast at home, lunch in New York, and to return in time for the opera."[334] Von Opel also announced over radio: "In the end, we may try to penetrate into space, but that is still a dream. We know the experiments will concentrate the interests of the entire scientific and technical world on the construction of rockets, and all nations will shortly compete in the solution of the problem."[335] Nearly every German newspaper reported on the events, while connecting Opel's success to innovations in rocketry.[336] Von Opel's plans to innovate "rocket planes" were lauded as the next step in progress.

Ley participated in these events mostly as a skeptical onlooker and hesitant journalist. He despised this "big, carefully staged show," while he viewed these stunts as both dangerous to the cause of serious rocket research and detrimental to the goals of

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[332] Neufeld, *Von Braun*, 30.
[333] Tom Crouch, *Aiming for the Stars: The Dreamers and Doers of the Space Age* (Washington and London: Smithsonian Institution Press, 1999), 50.
[334] "Das Raketenauto rast! Experiment oder Fahrzeug der Zukunft?" *Vorwärts*, May 23,1928, 15.
[335] Translation taken from "Rocket Auto Tops 2 Miles a Minute: In Two Seconds von Opel Reaches 62 Miles an Hour at Berlin," *New York Times*, May 24, 1928, 6.
[336] The newspapers that covered these events most directly were *Berliner Morgenpost*, *Berliner Tageblatt*, *Deutsche Allgemeine Zeitung*, and *Vörwarts*.

the VfR.[337] The chief sin of Valier and von Opel involved the use of powder fuels. The fundamental contribution of Hermann Oberth and the central quest of rocket research related to the development of liquid fuels. A powder rocket was the "plaything of a pyrotechnist."[338] Theoretical investigation had shown that "powder rockets never would be much more efficient, than they are at present, in fact they were almost the most inefficient type conceivable."[339] If anything, powder rockets moved science into the direction of Goddard's research, not Oberth's theories. In Ley's mind, that direction was a complete waste of time.

Ley understood von Opel's role in the affair, because von Opel "saw an opportunity for purchasing unlimited publicity with what was for him small change."[340] Yet, here was Max Valier, a founder of the VfR and the foremost popularizer of rockets, participating in "headline stunts" instead of "serious research."[341] Ley recalled, "The sad truth was that Valier was serious, though mistaken in some of his ideas…"[342] Valier's actions undermined the entire cause of the VfR: "We had gone to extreme lengths to explain the numerous advantages of liquid-fuel rockets to anybody who would listen—and Valier went and made publicity for von Opel with commercial powder rockets!"[343] This publicity also damaged the credibility and respectability of the VfR, when Valier publicly associated the organization with his work for von Opel**.** Ley

[337] Ley, *Rockets* (1944), 115.
[338] Willy Ley, "The Rocket Controversy," *Armchair Science*, April 1935, 19.
[339] Ley, "What's Wrong with Rockets?" 39.
[340] Ley, "The End of the Rocket Society, part 1," 69.
[341] Ley, "How it All Began," 49.
[342] Willy Ley, Gallery Proof for *Inside the Orbit of the Earth*, 27.
[343] Ley, "The End of the Rocket Society, part 1" 69.

recalled: “Small wonder that this victory did not make us very happy… The efficiency of these runs had been below 1 per cent! The expense had been fantastic.”[344]

Ley became so enraged over the publicity that he removed Valier’s chapter from his book, just before it went to the presses. Also, he claimed that Valier “was all but expelled from the VfR.”[345] Most likely, Ley advocated for his removal, while Winkler hesitated. The society still relied on Valier autographs to generate new memberships. Indeed, Valier’s fame was a source of income for the VfR.[346] Additionally, Oberth may have offered some kind words of support for Valier.[347] Some of the VfR’s later programs for “rocket shows” included a display of one of von Opel’s rocket cars.[348] Regardless of the details, Ley despised this publicity. Valier had turned the VfR’s respectable efforts at popular science into a publicity stunt. He had become a charlatan for the cause. Ley prided himself and his own tactics in contrast to the public “nonsense” of Max Valier. His future efforts were meant to revive the scientific respectability of the cause, in spite of the damage done by Valier. He later recalled, “1928 had been quite noisy, but no real progress had been made.”[349] He added, “1929 was somewhat better.”[350]

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[344] Ley, *Rockets* (1944), 118.
[345] Ley, “The End of the Rocket Society, part 1,” 69.
[346] As described by Frank Winter, members who signed up three friends received a Max Valier autograph. Those who signed up 5 members could choose between a signed copy of a Valier lecture and a signed copy of Ley’s first book. The ultimate prize (for signing up 10 new members) was a signed copy of Valier’s *Der Vorstoss in den Weltenraum*. See Winter, *Prelude*, 36.
[347] Ley, *Rockets* (1958), 122.
[348] See Winter, *Prelude*, 36. *Die Rakete* also showcased the Valier/von Opel stunts. See “Der Raketenwagen,” *Die Rakete*, May 1928, 3. *Die Rakete* continued to publish excerpts from Valier’s works. See the October 1928 issue.
[349] Willy Ley, Gallery Proof for *Inside the Orbit of the Earth*, 28.
[350] Ibid.

A Biographical Detour

In the aftermath of the von Opel publicity, Ley spent much time researching and writing another book that little to do with rockets or space travel. It was a more ambitious, historical, and scholarly project: a biography of Conrad Gessner.[351] He titled the book *Konrad Gesner: Leben und Werk*. This book represented a shift back to his original passions, as well as an attempt to establish himself as general educator and scientific biographer.

Due to the book's limited scope, Ley did not write a comprehensive or definitive biography. Instead, he simply collected and simplified known facts about Gessner, while celebrating the life and contributions of the "father" of zoology. "The main thing I was trying to do," he wrote, "is collect and summarize the notes about Gesner from various fields, so as to eventually alleviate this burden for future works."[352] Because Gessner is remembered as a zoologist, Ley spent much time discussing his zoological works, to the detriment of Gessner's "literary" contributions. Also, with the goal of producing a book for the "wide circles of friends of natural science," Ley adopted a "flowing and possibly understandable" style, which he compared to French styles of popular science. For this reason, Ley decided not to clutter the text with citations and notes. He apparently saw no contradiction between collecting information for future researchers, while providing few citations.

The biography began by dwelling on the mysterious and ancient origins of natural science, which might date back to the beginning of medicine or even the observations of cavemen. "It is unknown, and the artistic impulses of Ice Age humans

[351] Willy Ley, *Konrad Gesner: Leben und Werk* (München: Verlag der Münchner Drucke, 1929).
[352] Ibid., 308.

will probably never be proven in great detail…"[353] Ley ruminated on primitive knowledge of the hunt and the most desirable animals. Early cave paintings may have served as the forerunners of zoological illustrations. When interest turned from practical needs to sheer wonder about the world, the roots of the scientific spirit took hold, albeit tied in with thoughts about the extraordinary and unusual. Although the origins are mysterious, the beginnings of modern scientific research are not. It followed a zigzag curve, similar to a technical diagram. In many of his later works, Ley would outline this zigzag model.

Beginning with a glorious rise in antiquity "with minor fluctuations up and down," natural science then plummeted into a "catastrophic wasteland" and "prolonged depression" amidst the "victory of Christian doctrines."[354] It was "far below zero throughout the Middle Ages" before reemerging during the Renaissance and rising even higher in the modern era with Humboldt and Darwin. Ley clarified that the descent into the "Dark Ages" only occurred in the West, because the heritage of the ancients moved to "other people… the Arabs." However, Ley claimed, they did not contribute to new knowledge. "Their main activity," he wrote, "was protecting and interpreting older goods."[355] Accordingly, Western science began again when it had its own practitioners who, unlike the Arabs, added new ideas and research methods. After purging out "medieval superstitions" and bringing together the "distortions of ancient texts," new researchers contributed important and essential insights. Uncritical compilations of known facts, legends, and myths became artifacts of the ancient past. Men of science now relied on observation and experimentation as "the only safe means" of unraveling

[353] Ibid., 1.
[354] Ibid., 310.
[355] Ibid.

the mysteries of nature. Gone were the days of intuition, mysticism, and pseudoscientific thought. Although there were precedents, Gessner exemplified a deliberate turn toward modern science and its methodology. His "tireless diligence" and "unusual knowledge" blazed a trail forward.

What follows is an entertaining and sympathetic account of Gessner as a bold thinker, fearless explorer, and meticulous collector. His life was the story of a "pioneer," who charted new frontiers of many different scientific fields.[356] Born into an age of new ideas, he matured out of a struggle to overcome poverty, obtain materials, and fulfill his understanding of the natural world. This struggle often involved self-sacrifice. He was also an interdisciplinary adventurer who combined his skills as both a scientist and an artist. His books of nature came alive. Gessner mixed genres. He searched for the truth as an open-minded scientist. He served as a model for future scientists and even science writers. To celebrate his life was to celebrate the spirit of human exploration.

On the Scene Again

As he researched and wrote this scientific biography, Ley grew more involved with the VfR. "As time went on," Ley recalled, "I did more and more of the club's work," which included secretarial and editorial duties. Ley also claimed, that by the summer of 1928, he "joined Winkler in the editorship of *The Rocket*."[357] Although the texts of *Die Rakete* do not indicate co-editorship, it seems clear that Ley became the group's chief international correspondent, and he used his language skills to build a

[356] Ibid., 3.
[357] Ley, "The End of the Rocket Society, part 1," 68.

transnational network of theorists, engineers, science fiction writers, and rocket enthusiasts. After Winkler stepped down as president, Ley became vice-president (while Oberth became a distant and disinterested president). In a later interview, Ley joked, "I was vice president, and for a long time, there was no president."[358] At this point, most of the organizational, secretarial, financial, and publicity responsibilities of the VfR fell to Ley. He also took on many duties associated with the publication of *Die Rakete*.[359] According to his later accounts, the VfR continued to grow, although 1928 brought "no real progress."[360]

1929 was a different story. Ley attempted to further excite and educate his audiences with a second edition of his *Die Fahrt ins Weltall*. It contained new material, particularly on the history of rockets.[361] It also offered a new foreword, written by Oberth, who praised the book as a useful introduction for lay readers. Oberth also claimed that Ley's 1926 edition was the "first truly popular German rocket book."[362] In spite of other competitors, Ley's text remained the "easiest to understand."[363]

The second edition was more than a simple popularization of the theories of Oberth. Ley offered a "completely reworked" edition with thirty illustrations. It attempted to put the rocket into a broader historical context. In fact, the history of the rocket was "a story all its own."[364] The text also outlined the accomplishments of Oberth's predecessors. The history of rocketry had a long list of pioneers and founding fathers. Ley wrote, "Since 1907, Hermann Oberth busied himself with a large problem,

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[358] Ley to von Braun, *The Conquest of Space: A Conversation*, 10:52-10:57
[359] Ley, *Rockets* (1958), 117.
[360] Ley, Gallery Proof for *Inside the Orbit of the Earth*, 28.
[361] See "Probekapital aus Ley: Die Fahrt ins Weltall," *Die Rakete*, April 1929.
[362] Hermann Oberth, "Vorwort," in Willy Ley, *Die Fahrt ins Weltall* (Leipzig: Hachmeister and Thal, 1929), 3.
[363] Ibid.
[364] "Probekapital aus Ley," *Die Rakete*, April 1929, 60.

just as Walter Hohmann had. In St. Petersburg there was even a lively debate between Esnault-Pelterie and Ziolkovsky…"[365] The text indicated Ley's broadening international focus. Progress in rocketry surrounded an international effort that was "tore to shreds" by the Great War.[366] The time was ripe for rebuilding international networks of scientists and engineers. Ley did his part to openly share knowledge.

Throughout the text, Ley reiterated his confidence about the coming age of rocket power. What began as a dream was now possible. The text also indicates Ley's evolving thinking about war rockets. Time and time again, the war rocket emerged as an ineffective novelty, used to supplement more effective artillery. As a stand-alone technology, it was practically worthless as a short-range device that offered very little payload. The war rocket was a thing of the past. The space rocket was a thing of the future.

The Woman in the Moon

October of 1929 marked the zenith of Germany's rocketry fad. The pinnacle of Ley's success surrounded an event "which seemed to have little to do with science but which was to have lasting influence."[367] "That event," Ley recalled, "was the premiere of a film, on October 15, 1929." It was titled *Frau im Mond* (*The Woman in the Mond*). Fritz Lang, the film's director, had already become famous for *Metropolis* and other films. In 1928, he was inspired by both the sensational publicity and serious writings on rocketry. So many Germans were excited about a future of interplanetary travel. A film

[365] Ibid., 61.
[366] Ibid.
[367] Ley, Gallery Proof for *Inside the Orbit of the Earth*, 29.

that depicted the German conquest of space could be profitable and awe-inspiring. It could also be visionary and scientific.

News of Lang's film was a godsend for the spaceflight advocates. According to Ley, "It is almost impossible to convey what magic that name had in Germany at that time."[368] Ley described the typical premiere of a Fritz Lang film in Berlin:

> The first showing… was something for which there was no equivalent anywhere as a social event. The audience—it was an unwritten but rigid rule that one had to wear full evening dress, not just a dinner jacket—comprised literally everybody of importance in the realm of arts and letters, with a heavy sprinkling of high government officials. It is not an exaggeration to say that a sudden collapse of the theater building during a Fritz Lang premiere would have deprived Germany of much of its intellectual leadership at one blow, leaving mostly those who for one reason or another had been unable to attend.

That Lang's film had to do with space travel via rockets could be a monumental boost to the cause. It "meant a means of spreading the idea which could hardly be surpassed in mass appeal and effectiveness." Ley and others also hoped that it might generate "sizeable" funds for rocket experimentation. What was even more encouraging to Ley was Lang's choice of Oberth as "scientific advisor." Clearly, here was a chance to hit it big, well beyond publicity stunts with solid-fuel rockets. The movie would credit Oberth as the real genius behind the rocket of the future. Surely that fame would translate into real funds for experimentation.

In his later books, Ley told and retold a series of humorous events surrounding the film and Oberth. Regarding the role of a consultant, Ley recalled, "At first they had Max Valier in mind as a scientific advisor, because he was doing most of the newspaper writing and his name was known."[369] Ley continued, "For some reason, he [Lang] decided that Max Valier was not the man for him, and he needed somebody better, so he

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[368] Ley, *Rockets* (1958), 124. Subsequent quotes in this paragraph are located on this page.
[369] Ley to von Braun, *The Conquest of Space: A Conversation*, 3:35-3:44.

wrote a long letter to professor Oberth… and had it sent as a telegram. And then Oberth came to Berlin."[370] Being accustomed to small Transylvanian towns, "unhurried small-town intellectuals," and leisurely study in Heidelberg and Munich, Oberth now "found himself in the very spot where the apparent turmoil of a big city appears wildest."[371] "Suddenly plunged into the strange atmosphere of fast-moving, efficient, flippant, and sophisticated Berlin," Oberth became "greatly confused by his surroundings."[372]

"His mental make-up," Ley wrote, "was strange indeed."[373] First came a period of "astonished disbelief that everything can be so different."[374] He arrived in foul spirits, stubbornly refusing to compromise any degree of scientific accuracy, even prior to meeting Fritz Lang. Oberth distrusted everyone and everything around him. To make matters worse, "He missed appointments because of his afternoon nap, told the truth about it, and was laughed at."[375] He also voiced his disapproval of Berliners, who "had no soul and were German-speaking Americans, hunting money all the time."[376] According to Ley, it was this "mystic inclination" that "naturally transformed Oberth into a Nazi in due course."[377]

Ley intervened, asserting himself not only as Oberth's guide in Berlin but also as a friendly intermediary, who could help Oberth understand the local dialect. Ley also tried to convince Oberth not to argue. "I began to needle Oberth," he claimed. "Professor," he said, "these are the movies, not just the movies even, Lang himself.

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[370] Ibid., 3:45-4:07.
[371] Ley, *Rockets* (1958), 125.
[372] Ibid.
[373] Ley, "The End of the Rocket Society, part 1," 72.
[374] Ley, *Rockets* (1958), 126.
[375] Ley, *Rockets* (1944), 122.
[376] Ley is quoting Oberth from memory here. Ley, "The End of the Rocket Society, part 1," 72.
[377] Ley, *Rockets* (1944), footnote on page 122. Ley also claimed, "I have it in writing from his own hand that he denounced me to his Nazi superior, stressing the fact that I was in correspondence with Ziolkovsky, Rynin, and Dr. Perelman."

Money doesn't matter here, this is where you can get the cash to transform your formulas into reality."[378] While Oberth "could not understand people," he would get angry at Ley for trying to advise him on manners and social skills.[379] Oberth continued to struggle with "ultrarapid" dialect, a complicated transportation network, and the foreign customs of the movie industry. In Berlin, he was out of his league.

Despite Oberth's difficulties, he was able to secure some funding from both the Ufa film company and Fritz Lang himself. The contract specified that Oberth construct a small liquid-fuel rocket, to be launched during the film's premiere. Although Ley claimed, "it was not in itself a bad scheme," what followed was a series of haphazard blunders. First, Oberth hired a "Hitler-voiced unemployed engineer" named Rudolf Nebel as first assistant.[380] Ley would later refer to Nebel as a deceitful con man who lacked experience as an engineer. Instead, he was a "salesman of mechanical kitchen gadgets… not the man Oberth needed."[381] Next, Oberth hired an exiled Russian student named Alexander Shershevsky, who was both a "frenetic communist" and "lazy by nature." According to Ley, Shershevsky "would much rather have discussed the concept of infinity in mathematics, the importance of radicalism in politics, and the great work they would be able to do if they only were at the Central Aero-Hydrodynamical Institute in Moscow."

"This trio," Ley described, "consisting of a bewildered theorist, a professed militarist, and a Bolshevist accidentally in disgrace, worked together, or tried to." Ultimately, they failed. Oberth made some experimental progress on his "Kegeldüse"

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[378] Ley, "The End of the Rocket Society, part 1," 70-71.
[379] Ibid., 73.
[380] Ibid.
[381] Ley, *Rockets* (1958), 127. All subsequent quotes in this paragraph and the next can be found on pages 127-130.

design, before an explosion nearly cost him his eyesight in one eye. Other events caused delays. Running out of time, Oberth "rapidly approached a nervous breakdown." He fled home for a week, and then briefly returned before leaving for good after making legal threats to the Ufa film company. According to Ley, Oberth later told the president of the VfR in 1934 "that he had not been accountable for his actions," because the explosion "had given him all the symptoms of shell shock and he had never completely recovered."

The entire engineering adventure resulted in failure. Ley later admitted, "Oberth, I regret to say, was not the proper man to do it. As a matter of fact, such a man did not exist at all. There was nobody at that time who had sufficient experience with liquid fuel rockets."[382] Oberth, in particular, "had no idea of how to go about it."[383] After all, "he was a theorist, not an engineer."[384] Nevertheless, the film depicted his vision of a future of human spaceflight.

What is amazing about this story is how very little Ley speaks of his own role in the publicity and content of *Frau im Mond*. Instead, he always credited Oberth as the scientific mind behind the film's realistic depiction of a rocket flight to the moon. He recalled: "The spaceship shown was not some 'artist's conception' but a design by Oberth. He had calculated all the dimensions, and the model shown in the movie was a precise scale model."[385] The film also credits Oberth as the sole technical consultant, while Oberth later recalled that Ley "was only an author."[386] Historian Frank Winter's popular account also credits Oberth with designing "the water launch technique," as

[382] Ley, *Rockets* (1944), 121.
[383] Ibid.
[384] Ibid.
[385] Ley, Gallery Proof for *Inside the Orbit of the Earth*, 29.
[386] Hermann Oberth, "Interview with Martin Harwit and Frank Winter," November 14 and 15, 1987, 33.

seen in the film's most dramatic moment.[387] To this day, most historical accounts of the film credit Oberth exclusively.

Consequently, it is interesting to read Fritz Lang's memories of the events in an obituary of Ley.[388] Lang attempted to set the record straight: "I met him [Ley] in 1927. He was 21 years old and had already written two books on space travel which had been published in Germany in 1926… I contacted him because I planned to make a picture 'Frau im Mond.'" If this recollection is accurate, then Ley and Lang first met in the fall of 1927. Ley's "two books" could refer to *Die Fahrt* and *Mars*. Lang also recalled, "I was very much impressed with Willy Ley from the beginning on as much with his humility as with his tremendous technical knowledge of the subject…" Lang's remark about Ley's humility may have a deeper meaning in relation to the film. Lang also recalled that they "became friends in the truest sense of the word." This friendship would last a lifetime. It was a friendship that grew during Ley's work on *Frau im Mond*. Lang continued: "He suggested we call in Prof. Hermann Oberth…[who] came to Berlin, and with the great help of Willy Ley a concept of space flight was developed which I portrayed in my picture." Lang then credits Ley as the film's consultant:

> The work he [Ley] had done as consultant and adviser to the film "Woman in the Moon" was amazing. The models of the spaceship, really a highly advanced model of a rocket, the trajectories and the orbits of the modular capsule from the earth, around the earth and to the moon and back, were so accurate that the Gestapo confiscated not only all models of the spaceship but also all foreign prints of the picture.

[387] Frank Winter, "Frau im Mond: Fritz's Lang's Surprising, Silent Space Travel Classic," *Starlog*, January 1981, 40.
[388] Fritz Lang, "Sci-Fi Film-maker's Debt to Rocket Man Willy Ley, " *Los Angeles Times*, July 27 1969, P24. All following quotes come from this one-page article.

Lang credits Ley as the inspiration for the film, saying, "Willy Ley had already originated the concept of space flight of a rocket from the earth to the moon, which enabled me to make my film."

It would be easy to dismiss Lang's account as an embellished obituary of a dear friend. Yet, the tale is quite plausible, because it reveals a recurrent feature of Ley's entire career: He could become the man behind the curtain, working with movie directors, television executives, and other cultural producers. As he simultaneously shaped the content of the production, he credited the spaceflight imagery to Oberth (or later von Braun). With *Frau im Mond*, there is every reason to suspect that he was deeply involved with the planning of the movie. If there was a book that inspired Lang or his wife, the scriptwriter Thea von Harbou, it was neither Oberth's unreadable mathematical treatise, nor his more readable book, published in 1929 as *Wege zur Raumschiffahrt*.[389] Instead, it was Ley's translations of Oberth's concepts, either in person or in book form. Lang first consulted Ley, who suggested that they invite Oberth. Most likely, Ley and Lang wanted to attach Oberth's name to the film to give it some degree of scientific respectability. After Oberth arrived in a foul mood, Ley accompanied him to the studio to tour the set.[390] While Oberth proved difficult to work with, Ley and Lang got along splendidly. Ley later claimed, "I got involved in the film myself" after the arrival of Oberth.[391] Ley's version of these events may have hidden his contributions to the film, in order to give Oberth full credit.[392] Whereas his early

[389] Hermann Oberth, *Wege zur Raumschiffahrt* (München und Berlin: R. Oldenbourg, 1929).
[390] Willy Ley, "Eight Days in the Story of Rocketry" *Thrilling Wonders Stories*, December 1937, 61
[391] Ley, "How it All Began," 50.
[392] Frank Winter also ascribe certain features of the film to Ley: "Twenty-two year old Ley… had taken enough courses in astronomy to serve also as technical advisor, mainly in the astronomical parts of the movie. Ley may also be credited for suggesting a half-orbit around the Earth for the *Frau im Mond* spaceship prior to heading for the Moon." See Winter, "Frau im Mond," 40.

accounts of these events entirely credit Oberth, a later account in the 1960s was more explicit. For example, in his 1944 edition of *Rockets*, Ley gives the impression that he was a science writer and journalist:

> The public waited for the experiment with an enthusiasm that looks incredible even in retrospect. The demand for information was so great that I had to write an article about rockets literally every day for several weeks. The enthusiasm was such that even a photograph of the spot on the Baltic coast rented for the experiment sold well as a picture postcard.[393]

In a 1960 account, Ley admitted: "I wrote most of the scientific publicity for the film."[394] It seems fairly certain that Ley was an active part of an "unparallel advertising campaign"[395] While he wrote article after article for the popular press, the Ufa film sold postcards, posters, and even "rocketlike kaleidoscopes through which peephole you could see 'the woman in the Moon,' with bare arms reaching for the stars."[396] Ley's was the film's chief publicist. His involvement with the producers may have been downplayed at the time for obvious reasons. He was also the film's chief intermediary, bringing the scientist together with the artist who would inspire the public imagination. Most likely, Ley had a direct consulting role.

Ley had legitimate reasons to feel proud of what he had accomplished, particularly on the night of the film's premiere, which he attended at the invitation of Lang. Ley recalled the scene as stunning, despite the absence of a publicity rocket launch. Ley added, "From Hugenberg to Einstein, you could, paradoxically speaking, see no one who wasn't there."[397] Ley then described the most important scene of the

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[393] Ley, *Rockets* (1944), 125.
[394] Ibid. 61. See also, Willy Ley, "Frau im Mond: Gedanken um Film, Roman und Problem," *Unterhaltungsbeilage*, August, 1929, 13-16;
[395] Storch Franz "Hermann Oberth und die Frau im Mond," *Neue Literatur* 20:9 (1929): 52.
[396] Storch, "Hermann Oberth," translated by Freeman, *How We Got to the Moon*, 45.
[397]Quoted and translated in Freeman, *How We Got to the Moon*, 46. Original source: Willy Ley, "Berlin spricht vom Raumschriff," *Die Rakete*, November/December 1929, 27-28.

film. As a multi-stage rocket is revealed to a contemporary-looking crowd, the spectators cheer wildly. After a dramatic countdown, the rocket launches and the bold adventurers struggle to cope with the physiological effects of space travel. It was spellbinding:

> There is without question no other scene, either on Earth or on the Moon, that would have ruffled the poise of this cool, reserved, expert audience—these journalists, scholars, diplomats, men of affluence, and film stars. In the face of these outstanding technical achievements, the audience exploded. Electrified, carried away. The fiery jets of this film rocket swept away their carefully prepared skepticism, indifference, and satiety with the same speed with which the rocket raced across the screen…[398]

Frau im Mond gave them "a small glimpse of the tremendous possibilities."[399]

Ley was pleased that a silent film could do so much to stir emotions and excite a crowd to envision a future of humans in space. It would only take time for rocket technology to catch up to the power of media technology.

Tactics and Tensions

It should be clear that Ley's formative years were characterized by an increasing commitment to popularization, scientific internationalism, the coordination of experts, and the mixing of genres. Ley's commitments and tactics during Germany's "rocketry fad" illustrate much about his underlying belief: science was open to both a larger international community of experts and a Western audience who could finance experiments. With the right intermediaries and translators, the specialists and the public

[398] Ibid., translations by Freeman.
[399] Ibid. Other historians have credited the film as a monumental achievement. For example, Winter wrote: "So far as is known, *Frau im Mond* is the first film, which apart from some technical flaws, seriously and believably depicted spaceflight. The movie plot, an insipid story, is of little of no consequence compared to the larger milestone." "Generally," Winter added, "the film's lunar scenes are as authentically stark as those encountered during the Apollo missions…" See Winter, "Frau im Mond," 40.

could come together. The public could even become the specialists' patron, if the audience became excited about the future. For the intermediaries and publicists, imagination became the most important tool. Imagination could directly shape the future. Ley's views on the role of imagination can be related to Stephen J. Pyne's summary of the viewpoint that the "only impediment… is imagination, as translated into political will, expressed as money."[400] Oberth and other theorists would achieve little by only speaking to each other in complex language. The specialists would be lost in isolation. The scientists needed an effective coordinator and popularizer. Their cause needed a publicist. Ley stepped into the scene to serve as a publicist. Meanwhile, he shaped his public persona in contrast to Oberth, as well as Valier.

There was a right and a wrong way to inspire the public. In Ley's view, a futuristic fantasy like *Frau im Mond* aided the scientific and engineering crusade, despite depicting an oxygen-filled atmosphere on the Moon. A movie could take a few artistic liberties. Oberth's refusal to compromise any degree of scientific accuracy was unreasonable to Ley. Again, he told Oberth, "Professor, these are the movies… Money doesn't matter here, this is where you can get the cash to transform your formulas into reality."[401] Oberth needed the public, and the public needed to be excited. Some latitude with popular media and sensationalism was necessary and even desirable. Yet, when it came to Valier and von Opel's stunts, Ley was far less forgiving. Although the rocket vehicles excited the German public, they did nothing to advance the cause, due to their reliance on powder fuels. Additionally, Valier increasingly spoke and looked like a charlatan and pseudoscientist. The public and the cause needed a more moderate

[400] Stephen J. Pyne, "Seeking Newer Worlds," 8.
[401] Ley, "The End of the Rocket Society, part 1," 70-71.

spokesperson who could persuade the public to invest in the future. Valier was a danger to the cause, in spite of being the group's most famous founder. Ley openly competed with Valier, while adopting a public persona that contrasted to Valier's more flamboyant style. In Ley's view, a popularizer could be a showman, if the show was respectable and generally honest. Most notably, the show could have lasting effect on public perceptions and popular support. Enthusiasm would lead to funding, which would undoubtedly lead to technological innovation.

In many ways, Ley shared a naïve view of technological innovation. On Oberth and Valier, Neufeld commented on the unrealistic expectations: "With the theoretical problems largely solved, they both felt that some millionaire or corporation would come along to finance rocket experiments leading to spaceflight in a few years."[402] Consequently, "they failed to anticipate that advanced rocketry would be an enormously expensive technology that could only be developed by large state-financed military-industrial complexes."[403] Ley could rightly be associated with this absurd optimism. Nevertheless, there is arguably an important distinction between Ley and other advocates. As an amateur historian of science, Ley most likely began to reflect on the influence of culture and how social hopes, intellectual dreams, and a broader context shaped science and technology. By no means were his views as well developed as the views of later historians. Yet, he thought in similar terms, even though his perspective was Whiggish. The pseudoscience of the "Dark Ages" reflected cultural obstacles, superstitious beliefs, and a lack of imagination. The science of the Enlightenment also reflected a broader context of social beliefs and expectations. Culture affected both the

[402] Neufeld, "Weimar Culture and Futuristic Technology," 731.
[403] Ibid.

development and application of science. For the field of rocketry, two factors must be maintained. A long-term effort became crucial for the future. First, the general public had to be excited, thereby creating a fertile environment for the dreamers and engineers. Second, the scene had to be international, open, and cooperative. A "republic of letters" among scientists of all nations would speak a common language of science. Specialists would combine energies to overcome parochialism and borders. Together, they would explore a new frontier after standing on the shoulders of giants.

Paradoxically, Ley's joint efforts had to confront the first moment of public excitement: Valier's public stunts and heightened nationalism accompanying the scene. Ley did not express a critique of nationalism when discussing Valier, but it is easy to imagine him feeling uncomfortable with the emerging tensions between his commitment to internationalism and the swell of nationalism during the rocketry fad. Perhaps Ley embodied the tensions of a broader scene. Regarding the cultural reasons for the emergence of the rocketry fad, Neufeld identified mainstream nationalism, widespread technological enthusiasm, and the flourishing of consumer culture as key explanations for the fad.[404] He also labeled the fad as "an expression of the Weimar Republic's forward-looking and innovative culture."[405] On both Germany and the Soviet Union: "The upheavals of the preceding decade had made these cultures unusually open to radical ideas."[406] Tom Crouch put the fad in more generalized terms: "politics, economics, and culture had paved the way for the coming of the rocket."[407] He continued:

[404] Ibid., 728.
[405] Neufeld, *The Rocket and the Reich*, 5.
[406] Neufeld, *Von Braun*, 25.
[407] Crouch, *Aiming for the Stars*, 42.

> The wave of interest in space travel… was an expression of the Zeitgeist, the spirit of the times. Bled dry and defeated in a catastrophic war, the German people had struggled with revolutionary upheaval, foreign occupation, political uncertainty, and financial collapse... The notion of flying off into space had a certain appeal for citizens of a nation perched on the edge of chaos.[408]

As such, Germany's rocketry fad was a sign of continuity, in which German technological achievements illustrated the survival of German ingenuity and brilliance, despite the odds. From the words of reporters and science fiction writers to the images of German advertisements, the rocket and the rocket plane signaled the dawn of a new era. Both newspapers and science fiction novels expressed a triumphal nationalism. As Crouch elaborated: "The image of one of Max Valier's rocket planes blasting off into space became a symbol of progress and the hope for a better tomorrow."[409] At the same time, these rocket spectacles dramatized "the value of science and technology for the purpose of convincing audiences to believe in the power of knowledge producers and consumers alike."[410] Celebrations of key technologies and key knowledge producers could easily adopt nationalistic language.

All of these points are valid and interesting, yet perhaps scholars could do more to explore the tensions at play. For example, the emergence of consumer and cosmopolitan culture could upset nationalistic sensibilities. Consumer culture was becoming international or Americanized, according to many cultural critics. Additionally, the glorification of technology could include a mixture of nationalistic dreams of revenge/rebirth and internationalist fantasies of peace, diplomacy, and a "winged gospel." Scholars have documented the tensions and contradictory

[408] Ibid., 48-50.
[409] Ibid., 51.
[410] Daum, "Varieties," 330.

representations of the airplane.[411] Few of these tensions have been explored in relation to rockets in the Weimar period.

Although an analysis of Ley's internationalism does not reveal how widespread these tensions were among other enthusiasts and amateurs, it provides an interesting case study that begins to explore conflicting ideologies and contradictory practices. As we will see in the next chapter, these tensions exploded with the triumph of technologically-minded nationalists. Ley became a key participant in a cultural and technological conflict. His internationalism, scientific restraint, and organizational hopes would be pushed to a breaking point.

[411] On aviation, see Joseph J. Corn, *The Winged Gospel: America's Romance with Aviation* (Baltimore: John Hopkins, 1983); David C. Courtwright, *Sky as Frontier: Adventure, Aviation, Empire* (College Station: Texas A&M Press, 2004); Robert Wohl, *A Passion for Wings: Aviation and the Western Imagination, 1908- 1918* (Yale: Yale University Press,1994); Dominick A. Pisano (ed.) *The Airplane in American Culture* (Ann Arbor: University of Michigan Press, 2003); Linda Raine, *The Dream of Civilized Warfare: World War I Flying Aces and the American Imagination* (Minneapolis: University of Minnesota Press, 2003)

Chapter 3: Diminishing Horizons and the Death of a "Science"

February 14th, 1935. The large ocean-liner Olympic set sail from Southampton, England to New York City, via a short port stop at Cherbourg, France. Willy Ley was onboard. As an escaping German refugee, he must have reflected on his family and friends. It is not clear whether or not he gave his goodbyes before escaping Nazi Germany. On this voyage, as he saw the European coast fade into the distance, he must also have reflected on his homeland and what it had become. He had loved Berlin during the Weimar Republic, particularly during the period of stabilization when the rocketry fad boomed. He had made a start as science writer and publicist for an international scientific organization. He had befriended important people, such as Fritz Lang. He had also contributed to an active period of rocket experimentation in 1931, when the field made notable progress, despite the economic realities of the Great Depression. Yet, by 1934, everything had collapsed. As a science writer, Ley was forbidden to communicate to the public. The VfR was dead. What had begun with success ended in bitter politics and embarrassing failures. In his view, the rise of Nazism essentially killed the field of rocketry. Ley hoped for a new start in United States.

Important questions can be asked: How did Ley perceive these events? How did he view the relationship between science and politics? How did Ley's own political views influence his activities and perceptions? In some ways, these questions are impossible to answer, because almost all evidence comes from Ley's later memoirs, written after he had escaped Nazi Germany. In these personal recollections, his anti-fascism is clear. Yet, in pre-1935 documents, the evidence is more ambiguous,

especially when Ley suspected that the Nazis were monitoring his correspondence. He also ended a newsletter with the words "Heil Hitler!"[412] It would be absurd to read this statement at face value, given the context of coercion and surveillance.

Although historians must ultimately rely on Ley's memoirs to reconstruct the events of the early 1930s, a few aspects can be verified by archival documents. In spite of the Nazi campaign against "international" (and often Jewish) scientists, Ley continued to cultivate international ties with foreign rocket societies. He openly shared technical information. In 1934, he even suggested that the members of the defunct VfR join with both the British Interplanetary Society and the American Rocket Society. He sought to consolidate all associations into an international forum for communication and scientific cooperation. Earlier, in a 1932 letter, Ley ruminated about the possibility of receiving funds from a Russian society.[413] He actively exchanged information with the Soviet group GIRD.[414] Ley also published mathematic equations and formulas in the American publication *Astronautics*.[415] There is even evidence to suggest that Ley served as an intermediate between a Russian agent and Hermann Oberth.

By following Ley' s activities, not only can historians appreciate the genuine degree of scientific internationalism, but also they can recognize how Ley associated the decline of rocketry with the rise of German nationalism, as embodied by the Third Reich. Totalitarianism demanded secrecy, paranoia, state control, and the persecution of scientists and engineers. Thus, Ley viewed the state as detrimental to a scientific cause, which demanded international cooperation, publicity, and the open sharing of

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[412] See Winter, *Prelude*, 48. This language is absent from the same announcement that Ley sent to the American Rocket Society.
[413] Willy Ley to Pendray, July 27, 1932, Pendray Papers, Box 4, Folder 12, 1.
[414] Ibid.
[415] Willy Ley, "The Why of Liquid Propellants for Rockets," *Astronautics* 22 (Aug.-Sept., 1932): 1-2.

information. He also associated the rise of Nazism with the rise of pseudoscientific movements. Nazism, irrational politics, and pseudoscientific "nonsense" poisoned Germany's scientific and engineering well. For Ley, the situation became desperate. These associations between totalitarianism/pseudoscience and democracy/public science would grow stronger in later years. His experiences formed the foundation of an anti-totalitarian conception of science and its practitioners. This chapter will demonstrate how stark realities contributed to a stark dichotomy that would be advanced for many decades to come.

The Starfield Company

At the height of Germany's rocketry fad, Ley wrote a science fiction novel called *Die Starfield Company*.[416] The book is quite remarkable, because it reflected Ley's mindset in 1929, when he had such high hopes for the field of rocketry and the international scene. The novel is also remarkable for its contrasts with other German science fiction novels. Here, it is important to recognize the diversity of German interwar science fiction. German fantasies of the future could range from left to right on the political spectrum. Yet, many scholars still point to common themes that distinguished German science fiction as an incredibly nationalistic and even fascist literature that often combined fantasies of revenge and cultural rebirth with glorifications of wonder weapons. For example, scholar Manfred Nagl argued that German science fiction distinguished itself by fusing technicality with mysticism and

[416] For detailed information about Ley's first science fiction novel, see Willy Ley, Wolfgang Both, and Klaus Scheffer, *Die Starfield Company* (Berlin: Shayol, 2011). This novel was originally serialized in 1929. In addition to providing the full text of the novel, Both and Scheffer included a very useful appendix of key documents relating to Ley, *Frau im Mond*, and *Das Neue Fahrzeug*.

occultism. "Only German SF," he argued, "continuously propagated such a mad and isolated system of up-to-date technology and regressive mysticism, interfused with occultism, racist metaphysics, the cult of a dictatorial führer, and anti-communism."[417] Nagl further claimed, "German SF in general anticipated the ideology of National Socialism."[418] In less generalized ways, Peter S. Fisher made similar claims by arguing that these novels "were not merely the self-serving fabrications of isolated malcontents… Instead, visions of revenge and renewal were converted into a literature of mass consumption."[419] Fisher added, "Hitler's own vision of the future would find a receptive audience in a population that had largely shifted its hopes and aspirations to a realm where dreams merged with the call for a national savior."[420]

From the technological fantasies of Hans Dominik to the lesser-known works of aspiring authors, German science fiction depicted the renewal of a Teutonic empire in the sky and beyond, along with the crushing defeat of Great Britain and France. These political fantasies could be incredibly nationalistic. Take, for example, a passage from Otto Willi Gail's *Der Schuss ins All* (1925), in which the main engineer shouts:

> The Dirigible, the Graf Zeppelin, years ago spread over the whole earth the fame of German spirit, German technique, and German work, so that our former enemies recognized that this nation was alive, despite all suppression… And now the lofty music of German ability shall resound in the canopy of stars—to distant unknown worlds, the German colors shall shine and announce that *this nation lives!*[421]

Other novels could openly advocate for war, as done by a character in Ludwig Anton's *Interplanetary Bridges* (1922):

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[417] Manfred Nagl, "National Peculiarities of German SF," *Science-Fiction Studies* 8 (1981): 31. See also, "SF, Occult Sciences, and Nazi Myths," *SFS* 3(1974): 185-197.
[418] Ibid.
[419] Peter S. Fisher, *Fantasy and Politics: Visions of the Future in the Weimar Republic* (Madison, Wisconsin: The University of Wisconsin Press, 1991), 6.
[420] Ibid., 20.
[421] Otto Willi Gail, *Der Schuss ins All: Ein Roman von Morgan* (Breslau: Bergstadtverlag, 1925), 30-36.

> Once we have sunk one or two English or Japanese men-of-war [with our airship]… once we have shown the world that we have sharp claws and know how to use them, then, and only then… they will recognize us as an equal power, make commercial and political treaties with us and invite us to join their League of Nations. And then Germany's time will have come to maintain her old-time prestige against all the nations of the world.[422]

Although there are several exceptions, German science fiction was characterized by a fierce combination of machine dreams, nationalistic passions, and right-wing fantasies. Quite often, the genre distinguished itself by voicing anti-democratic critiques of bureaucracy, while simultaneously voicing the need for a dictatorial great leader, along with the harmonious *Gemeinshaft* (community) that accompanied his reign. As such, it is nearly impossible not to read these stories as proto-fascist.

Ley's *Die Starfield Company* was different. Rather than promoting airships and rockets of the future as the means to restore the German empire, Ley presents a tale of international cooperation, set in the 1980s. The story also glorifies rocket technology as the future of travel.[423] The main character, Frank Daybor, is the German-born director of the "Transcontinental," which is the West's largest airline. In order to combat a group of mysterious "air pirates," Frank teams up with Cora Samdarava, "mistress" of the Starfield Company, an India-based airline company. What follows is an interracial love story between Frank and Cora, as they share intimate moments in the sky, whether alone on observation decks or in the crowded control rooms of large battle zeppelins. Through joint efforts in times of danger, the European and the Indian grow to

[422] Ludwig Anton, *Brücken über den Weltenraum* (Bad Rothefelde: Holzwarth-Verlag, 1922). For translation, see "Interplanetary Bridges," *Wonder Stories Quarterly* 4:2 (1933).
[423] For a detailed analysis of the novel's promotion of rocket theories and other spaceflight technologies, see Both and Scheffer. It is also evident that the earlier adventures of "Captain Mors" heavily influenced many of Ley's plot points.

understand one another out of mutual respect and affection for each other's exotic nature.

Although Frank is German by birth, his German roots are incidental. He considers himself simply as a Westerner, in command of an internationally focused company. Cora is the most complex character, and she has a more difficult time with her mixed heritage. She is torn between a world of the past and a world of the future. As the "mistress" of the Starfield Company, Cora is both a traditional religious figure for her people and a modern pilot. Her wardrobe constantly changes from eastern and feminine silks to western and masculine flight gear. She is in a constant fight between two sides of herself and two camps of her people. One wing fights to modernize through technological and engineering might, while the other side/camp fights to preserve Indian tradition and identity.

By combining forces, the West and the East eventually defeat the space pirates by constructing a shuttle-like rocket ship that launches to a "second moon," which is the base of the invaders. The pirates are extraterrestrials whose intentions are hostile, but unclear. The Starfield Company then launches rocket missiles that destroy the second moon. Their successful fight against the foreign menace has not only united Cora and Frank, but is has also united many nations of the world, which come together in solidarity and peace. In some ways, the international airship companies have become far more powerful than traditional nation states with outdated armies. Cora and Frank's technologies have also shrunk the globe as more and more people feel at home in the air, free to luncheon in Paris before sight-seeing in the tropics.

After saving the world from the extraterrestrial threat, Frank and Cora marry. Arguably, their union represents the pinnacle of international and cross-cultural understanding by two individuals who have become far more powerful than traditional heads of state. Eventually, Frank settles down for a career of teaching future space cadets, while Cora spends her days in the skies. The characters live happily ever after.

"Success, Failure, and Politics"

Ley soon viewed events as taking a turn for the worse. In later memoirs, he described 1929-1933 as a time of "success, failure, and politics." Prior to the Great Depression, Valier's "cheap publicity stunt" had almost defeated the cause.[424] "What had started out as a kind of scientific movement," Ley explained, "was almost smothered under a series of publicity stunts."[425] He wrote: "The result was that there were three groups, suddenly, one [Oberth in Transylvania] with ideas and scientific proof but without money, the VfR [Winkler and Ley], and two [von Opel and Valier] with money who played with powder rockets."[426] In reality, the VfR had always been loosely organized, which makes it difficult to date the first experiments.[427] Valier's experiments with rocket cars came in association with the VfR as remotely as Winkler's early work. Although Valier's spectacles garnered much public support, they also "proved to be the last straw for the already strained relationship between the querulous and suspicious Oberth and the technically untutored Valier."[428] Ley might have added a personal note about the strained relationship between Oberth and himself.

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[424] Ley, *Rockets* (1958), 122.
[425] Ibid., 123.
[426] Ley, "The End of the Rocket Society, part 1," 69. Bracketed information was written by Ley.
[427] Winter, *Prelude*, 37.
[428] Neufeld, *The Rocket and the Reich*, 10.

He later wrote, "To say that things looked bleak by the end of 1929 is to understate matters. The Oberth rocket had failed to materialize. Winkler was forced to abandon publication of the monthly journal Die Rakete."[429] Ley added, "Even the film [*Frau im Mond*] was only moderately successful."[430] Despite the lavish premiere of the film, it was competing with "talkies." Ley recalled, "every town had at least one movie theater wired for sound…"[431] He also remarked that the film had "dazzled us into confusion…"[432]

To make matters worse, 1929 marked the ascension of Rudolf Nebel in the ranks of the VfR. Nebel had served as Oberth's first assistant on the publicity rocket fiasco, which brought him prestige in the circles of Oberth's followers. Ley despised his tactics and personality. Historians have confirmed Ley perceptions of Nebel as "more or a master manipulator and operator than an engineer."[433] In fact, Ley did not mince words when it came to his impressions of Nebel as "a professed militarist" and later Nazi who lacked qualifications to work as Oberth's assistant.[434] Ley recalled: "Nebel himself told me later, without regarding it as a personal secret, that he had been graduated in a hurry during the war because he had volunteered for the air arm, and that after the war he had never worked as a designing engineer but for some time as a salesman of mechanical kitchen gadgets."[435] Additionally, when Ley and Nebel first met during a chance

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[429] Willy Ley, *Rockets, Missiles, and Space Travel* (New York: Viking, 1951 edition, fourth printing, 1952), 131. According to Frank Winter, with the disappearance of *Die Rakete*, the group immediately lost over 600 members. See Winter, *Prelude*, 37.
[430] Ley, *Rockets* (1951), 131.
[431] Ibid.
[432] Ibid.
[433] Winter, *Prelude*, 38.
[434] Willy Ley, *Rockets, Missiles, and Men in Space* (New York: Viking, 1968), 117.
[435] Ley, *Rockets* (1958), 126-127.

encounter in 1929, Ley was "dumbfounded."[436] Nebel took a moment to brainstorm how a spaceflight society might be formed to further experimentation. Ley recalled: "I could not see any reason why he should want to compete with the VfR, but, on the other hand, he did not sound as if he did want to. I asked him outright and learned that he did not know of the existence of the society. Oberth, although he was president of the VfR, had never mentioned it."[437] Although Ley's perceptions of Nebel and his qualifications are contradicted by Nebel's own autobiography, it is clear that Ley resented his entrance into the core group of theorists and engineers.

Yet Ley continued to support the VfR. In fact, he later claimed: "What saved the situation was the fact that early in the same year Johannes Winkler has resigned as president of the VfR for personal reasons. Professor Oberth had become president and I vice-president."[438] From Ley's perspective, the presidency now became an honorary title: "I did most of the work, consequently the headquarters of the society were transferred to Berlin—actually, not legally."[439] Ley was essentially running the VfR in the donated office space of a patent attorney named Erich Wurm.[440]

Soon, tragedy struck. When Max Valier began to experiment with liquid fuels in May of 1930, his prototype motor exploded. A "steel splinter cut the aorta," Ley recounted.[441] Valier "bled to death before anybody could do anything about it."[442] The accidental death created a small public outcry against rocket experimentation. This outcry had been building momentum since the death of an adolescent boy who "was

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[436] Ibid., 131.
[437] Ibid., 131-132
[438] Ley, *Rockets* (1968), 121.
[439] Ley, "The End of the Rocket Society, part 1," 70.
[440] Ley, *Rockets* (1968), 121.
[441] Ley, *Rockets* (1958), 135
[442] Ibid.

trying to build a large model of the Opel rocket car."[443] This public outcry led to the introduction of an unsuccessful bill in the Reichstag, aimed at banning rocket experimentation.[444] Ley commented: "Valier's death was especially tragic in view of the fact that nothing had ever happened to him during all his dangerous and useless experiments with powder rockets. He died while engaged in his first really useful experiment, although the idea of mounting his motor in a car was, of course, ridiculous."[445]

What follows in Ley's many accounts is a mixture of successes and embarrassments. On the one hand, the VfR now included engineers Klaus Riedel and Rolf Engel, as well as the 18-year-old Wernher von Braun. Ley had brought von Braun into the group after von Braun showed up at Ley's home, hoping to be introduced to Oberth. Ley later described his first impressions of von Braun as "a perfect example of the type labeled 'Aryan Nordic' by the Nazis during the years to come."[446] With the work of these competent engineers, attempts to perfect Oberth's "Kegelduse" culminated in a successful test firing on July 23, 1930.[447] By September, key members of the group were also successfully testing newly-designed "Mirak" rockets. Then, Nebel furthered the goals of experimentation by persuading Berlin officials to lease an abandoned army garrison in a northern suburb. Nebel dubbed the site "Raketenflugplatz Berlin." It was soon occupied by a ragtag group of unemployed and desperate engineers, including Herbert Schaeffer, who would eventually become one of Ley's closest companions. Albert Einstein's son-in-law described these men as "officers

[443] Ibid., footnote.
[444] Neufeld, *The Rocket and the Reich*, 11.
[445] Ley, *Rockets* (1958), 136.
[446] Quoted in Neufeld, *The Rocket and the Reich*, 43.
[447] Winter, *Prelude*, 39.

living under military discipline… Not one of them was married, none of them smoked or drank. They belonged exclusively to a world dominated by one single wholehearted idea."[448]

Other experiments followed, including test flights of the "Repulsor." According to Ley, the site produced 87 rocket flights and more than 270 static tests.[449] It is clear from his histories of the events, Ley witnessed many of these experiments. He attended these events both as a "spectator" and as the chief organizer of the VfR. He was not primarily an engineer or a designer, with the possible exception of the Repulsor.[450] Yet, in many ways, he was one of the group's key spokesmen. It also seems likely that Ley served as a chief intermediary to the Ufa Film Company, which used its 16th newsreel to promote the Raketenflugplatz.[451]

In the early days of the "rocket airdrome," Ley was optimistic about their agenda: "We did have a program of sorts, but while we knew precisely what we were *not* going to do, we could not formulate clearly what it was we were going to do."[452] He added: "On the negative side we were certain that we would not touch solid fuels of any form. We also were not going to stick a rocket motor for liquid fuels on a car, railroad car, or glider. We were, in short, not going to do anything but build rockets."[453] In a more direct account, he bluntly claimed, "There was to be no nonsense about rocket

[448] Quoted in Winter, *Prelude*, 42. Source in footnote: Marianoff and Wayne, 1944, 115.
[449] This information comes from Ley's private notes, as quoted in Winter, *Prelude*, 43.
[450] Ley often gave the impression that he directly participated in the design. On the question of who should be credited with the repulsor, he wrote: "We never paid any attention to the question of who had thought of what, knowing that it was a long way from our experiments to definite shapes, and knowing also that our glory was a collective glory." See Ley, *Rockets* (1958), 142.
[451] Ibid., 151.
[452] Ibid., 139.
[453] Ibid.

cars."[454] Ley further added: "It was exceedingly obvious… that one had to look upon a rocket as an embryonic spaceship."[455] He also claimed that the overarching goal of early rocket experimentation, both in Germany and abroad, involved "honest and very serious attempts to solve purely scientific problems…"[456] He elaborated: "I happen to know with absolute certainty that they were not 'attempts to reach the moon.' Neither were they 'forerunners of transatlantic rocket airplanes.' And they were also not, as could be read occasionally in European newspapers, 'future deadly instruments of war.'"[457]

Overall, in spite of economic difficulties and the folding of *Die Rakete*, the VfR survived. The establishment of the Raketenflugplatz inaugurated the dawn of experimental rocketry: "The scheme worked very nicely for one year…"[458] Ley wasted no time promoting the organization in foreign publications. For example, he wrote to *Wonder Stories* in the fall of 1930. In response to its report on the American Interplanetary Society (later named the American Rocket Society), Ley responded: "we beg you, to tell your readers, that there is in Germany a similar society… with more than 1000 members."[459] He added, "there is no 'rocket-scientist' in Europe, who is not a member of our 'Verein.'"[460] A few months later, Ley announced the various accomplishments of the group to *Wonder Stories*. Despite the folding of *Die Rakete*, Ley stated, "we merely want to inform America… that the German Interplanetary

[454] Ley, *Rockets* (1944), 136.
[455] Ley, *Rockets* (1958), 139.
[456] Ley, "What's Wrong with Rockets?" *Amazing Stories*, March 1940, 39.
[457] Ibid.
[458] Ibid., 49.
[459] Willy Ley, "The Reader Speaks," *Wonder Stories*, September 1930, 370.
[460] Ibid.

Society has not gone to sleep and that our work has brought the world another step nearer the final goal."[461]

On an organizational level, Oberth soon resigned his presidency, before Major Hans-Wolf von Dickhuth-Harrach accepted the job.[462] Yet, according to accounts, Nebel became the "de facto" leader of the group. The engineers constructed several test stands, while Nebel and Ley used ingenious and sometimes questionable methods to secure diverse materials and garner public support. According to Ley, Nebel was often dishonest with his tactics. For example, Ley recalled:

> At a time when nobody could even form an approximately correct conception of the probable size and shape of an instrument-carrying meteorological rocket Nebel promised that man-carrying rockets could be built on short notice and he began a discussion of the theory of the station in space with the words: "Judging from our recent experience in this matter…"[463]

When Ley told Nebel that his claims could not be substantiated, Nebel responded, "That doesn't matter, advertising and science are two different things. I'm a specialist in successful salesmanship."[464] Ley believed that Nebel's success with this approach "was always short-lived. He did get a lot out of people in the way of donations, but he never got anything more than once."[465] The group needed a long-term strategy. They also needed to be honest with the public. Ley's tolerance for Nebel's tactics grew thin.

The VfR continued to organize lectures and rocket displays, such as an event on the 30th of April in the public auditorium of the General Post Office in Berlin. Interested attendees could view an Oberth-designed rocket, which hung from the ceiling by

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[461] Willy Ley, "The Reader Speaks," *Wonder Stories*, January 1931, 900.
[462] Winter, *Prelude*, 40
[463] Ley, "The End of the Rocket Society, part 2," *Astounding Science-Fiction*, September 1943, 69-70.
[464] Ibid.
[465] Ibid.

parachute.[466] Similar events happened in May during "Aviation Week" at Potsdamer Platz, as well as within the basement of a large Berlin variety store.[467] According to Ley's notes, there were 23 demonstrations for clubs and other societies together with 9 simply "for publicity."[468]

Overall, "the year 1931 brought real progress."[469] Ley remembered, "everything, or most everything, went fine… Our finances were all right. Most members paid their dues… Various public meetings and lectures brought in some more money and the demonstrations helped greatly."[470] All the while, engineers made real progress, particularly when it came to the "Repulsor" test flights. Ley fondly recalled the role of the Raketenflugplatz in providing "shelter, food and a little pocket money to unemployed mechanics…"[471] Socialists and pacifists were welcomed at the site, in spite of Nebel's politics and his "loud and accented voice, surprisingly much like Hitler's."[472]

Ley's international correspondence also increased, as he openly shared information with the British and American equivalents of the VfR. In particular, he corresponded quite often with G. Edward Pendray of the American Interplanetary Society, who had begun to popularize spaceflight in the United States, most notably in the *New York Herald Tribune*.[473] When Pendray visited the Raketenflugplatz in April of

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[466] Winter, *Prelude*, 40.
[467] Ibid.
[468] Ibid., 43
[469] Willy Ley, Gallery Proof for *Inside the Orbit of the Earth*, 30.
[470] Ley, "The End of the Rocket Society, part 2," 62.
[471] Ibid., 68.
[472] Ibid., 69.
[473] Many interesting pieces of information about Pendray and his early experiments can be found in John Cheng's *Astounding Wonder: Imagining Science and Science Fiction in Interwar America* (Philadelphia: University of Pennsylvania Press, 2012).

1931, Ley served as his host.[474] According to Ley, this visit marked a few misunderstandings because "Pendray did not speak German and my English was very poor."[475] Nevertheless, they got along well, and Pendray reported on the group's activities and accomplishment in the club's "journal," *Astronautics*. Ley also wrote technical articles for *Astronautics*.[476]

Ley's meeting and correspondence with Pendray marked the beginning of a friendship. Ley openly shared technical information with Pendray. While Goddard and Oberth worked in secrecy, Ley outlined the details of tests on postcards.[477] His correspondence reflected his general attitude about international cooperation among a field of pioneers. In a comment about Goddard (that probably irked Pendray), Ley wrote, "I don't think very high on the works of Goddard, you know. Not, because he is one of your own men, but because he always has his 'secrets.' I have always learned, men with secrets have no secrets, - his last plan for a rocket- plane was pure nonsense. Bluff, only!"[478] Secrets were a sign of weakness, not strength.

Ley also attempted to use Pendray as a key American contact. In 1931, Ley asked Pendray for a copy of Goddard's *A Method of Reaching Extreme Altitudes*. "I have read the book, but the copy belonged to the Bibliothek of the University," he

[474] It is clear from a March 5, 1931 letter that Pendray wrote to Ley to inform him of his trip to the site. Pendray was hoping to also meet Oberth. Ley responded: "But all the experiments of the last time were no[t] made by Prof. Oberth, but by Eng. Nebel and he is waiting for you like myself." PP, Box 3, Folder 16, "Early, 1931," 1.
[475] Ley, *Rockets* (1944), footnote, 137.
[476] See, for example, "The Why of Liquid Propellants," 1-2. In this issue, Ley also wrote a short article "On Rockets and their History." See pages 4-5.
[477] On shared technical information about the "repulsor" rockets, see Ley to Pendray, May 25th, 1931, PP, Box 3, Folder 16, "Early 1931" 1. By 1932, Ley was boldly sharing technical information via postcards. See, for example, Ley to Pendray, December 4, 1932, in PP, "Ley Willy, 1932."
[478] Ley to Pendray, January 5, 1932, PP, Box 4, folder 12, 2.

claimed.[479] He also asked for Pendray's help in relaying his novel, *Die Starfield Company*, to a Gernsback publication. He stated, "You know I would very much like to see my story printed in English."[480] On a personal note, he added, "Don't fear for our safety. The communist one-act-plays are only in certain streets in the slums and only for one or two days."[481]

These types of personal notes increased in the coming months. For example, Ley gave Pendray a long-winded explanation for the increasing tensions between the VfR and Oberth. According to Ley, Oberth intended on continuing his experiments in a secretive fashion in his own country. He also "doesn't like to be President of a society in another country and that is true! We finally think the same."[482] Ley expressed his optimism: "Now we are working without connection to him and we are sure, we shall do good work."[483] During this time, Pendray was sending Ley many different English articles, as well as science fiction stories, including his own *The Earth Tube*. Ley sincerely thanked him for helping to improving his English reading ability. Ley was particularly pleased to receive news of a replacement copy of Lasser's *The Conquest of Space*.[484] He also asked Pendray to send *Die Starfield Company* back to him, if a translator could not be found.[485]

The situation soon took a turn for the worse. When a one-stick Repulsor rocket detoured and crashed into a police building, "any further experimentation was forbidden

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[479] Ley to Pendray, August 20, 1931, 3. PP, "Early Rocketeers – Willy Ley, Biography and Correspondence, 1931." Ley mistakenly cited the date of Goddard's publication as 1916.
[480] Ibid., 1.
[481] Ibid., 2.
[482] Ley to Pendray, May 4, 1931, PP, "Early Rocketeers," 1.
[483] Ibid., 2.
[484] Ley to Pendray, October 10, 1932, PP, box 4, folder 12, 1. According to a different letter, this copy never arrived.
[485] Ley to Pendray, July 23, 1931, PP, "Early Rocketeers," 1.

then and there."[486] Fortunately for the team, the police agreed to lift the ban under new conditions. Then, with worsening economic conditions, membership in the VfR continued to decline while sources of funding diminished. A key investor, Hugo Hückel, could no longer support the group. Then, the board of directors agreed (probably overruling Ley's objections) to plan and advertise a manned rocket flight. Ley vaguely disguised his protest, telling readers, "Nebel spoke about the next plans of the VfR. Because the VfR wants to do scientific work, it needs money. But nobody is so much interested to spend even smaller sums for this purpose, they all want to see sensational rocket-shots." In a revealing statement about the VfR's connection to the later "Magdeburg Project," Ley wrote, "The Vorstand of the society agreed under these circumstances to do ONCE a real show – work and build the first manned rocket for liquid propellants."[487]

Ley lamented the deteriorating situation:

> The newsreel and our victory over the police were our last triumphs. What followed afterward was a hopeless struggle against political tension and economic misery. It was a hard winter climatically. And it was the fatal winter under Chancellor Bruening when Adolf Hitler suddenly assumed prominence. It was a winter during which the roster of VfR members shrank to less than three hundred, most of them deprived of their livelihood. It was a winter during which there came many letters saying that no further dues would be forthcoming because "all money belongs to the Führer."[488]

Ley claimed, "the general situation was deteriorating from day to day. Nerves were frayed; practically every meeting of the Board of Directors… led to violent clashes,

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[486] Ley, *Rockets* (1958), 151.
[487] See manuscript, Willy Ley, "Around European Rocketry," in box 4, folder 12 of PP, 1. Although Ley would later claim that the VfR had little to do with the Magdeburg project to launch a manned rocket, evidence suggests the centrality of the VfR as an organization that sponsored the launch. In a later issue of *Startling Stories*, Ley referenced "The 'Magdeburg Rocket' of the German Rocket Society's research group, finished in June 1933." See Willy Ley, "The Road to Space Travel: Part 1 The Last Twelve Years," *Startling Stories*, March 1949, 71.
[488] Ley, *Rockets* (1958), 152.

caused by, in the last analysis, political difference. The deterioration was rapid…"[489] Rudolf Nebel became intolerable, according to Ley. He "attacked everything and everybody."[490] He openly criticized Ley for sharing information with the newly renamed American Rocket Society.[491] "Speaking with a careful imitation of Hitler's mannerisms," Ley recounted, "he declared that he would leave the VfR to die and join the army."[492] Nebel is also reported to have claimed, "If we say it can work, we'll get army money to try it."[493]

Earlier, in December 1931, Ley left Berlin. He later claimed, "In order to raise money I went on a lecture tour in East Prussia."[494] Ley gave readers the impression that his trip was a virtual blitzkrieg of publicity. For example, in 1943, he claimed, "Around the middle of December, 1931, I knew that I would have about a week in January or February to visit my parents living in Königsberg in East Prussia."[495] He described the trip:

> Sunday, radio; Monday, Engineering Society; Tuesday: free; Wednesday, University, Geographical Seminary; Thursday, Merchant's League; Friday: University, Department of Physics, Saturday: free; Sunday: radio again. I did not speak a word without being paid for it, and the VfR got half of the gross proceeds. When I got back to Berlin I slept for a full day: six lectures in eight days, plus an eight-hundred-mile round trip, is work.[496]

According to a letter to Pendray, his trip was much longer, from December 10th until February 1st.[497] Ley also later wrote, "My lectures were not spaced very closely," which

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[489] Ibid., 153-154.
[490] Ley, *Rockets* (1944), 150.
[491] Ibid.
[492] Ibid.
[493] Quoted in Sharpe and Ordway III, *The Rocket Team* (Boston: The MIT Press, 1982), 16.
[494] Ley, *Rockets* (1958), 152
[495] Ley, "The End of the Rocket Society, part 2," 59.
[496] Ibid.
[497] Letter from Ley to Pendray, January 5, 1932, PP, Box 4, folder 12, 1.

contradicts the later account.[498] The longer version of events is accurate, given the details within his correspondence with Pendray. For the most part, Ley's "lecture tour" was an extended vacation with friends and family, interrupted by occasional efforts to raise money for the VfR. While in Königsberg, he may have witnessed political violence between the SA and Social Democrats.

When Ley returned to Berlin, he found the situation in dire straits. Nebel was militarizing the agenda. This collaboration with the Germany Army, according to Ley, "in retrospect looks like pure comedy."[499] After Nebel failed to persuade Hückel to continue his financial support of the group, Nebel wrote a "technically wholly inadequate and senseless 'Confidential Memo on Long-Range Rocket Artillery.'"[500] Soon afterwards, a "burglary attempt" indicated that someone was closely monitoring the site. Ley recalled: "And then I saw that we were no longer 'in all the rooms.' Somebody else was there: the busily plotting German army. Suddenly they supervised everything, unseen, but efficiently and some of Oberth's and Nebel's claims worked nicely into their hands."[501] During this time, Ley may have been a curious onlooker as plain-clothed generals visited the site.

Then, the German Army "ordered" a rocket demonstration at an Army proving ground at Kummersdorf.[502] As Neufeld explained, Colonel Karl Emil Becker of the Army Ordnance Office was particularly interested in powder rockets, because the Versailles Treaty omitted any mention of rocket development from the restrictions

[498] Ley, *Rockets* (1958), 153..
[499] Ibid., 155.
[500] Ibid.
[501] Ley, "The End of the Rocket Society, part 2," 70.
[502] Ley, *Rockets* (1944), 151.

imposed upon Germany.[503] As an "ultranationalist," he "yearned for the day when a new right-wing authoritarian regime could overthrow the treaty's onerous limits on military power."[504] Investigating the military potential of rocketry was a part of that effort. Without notifying the Board of Directors, Nebel took Riedel and von Braun along. Although the demonstration was not a success, according to Ley, "A month or so later the Army hired Wernher von Braun, who disappeared from our view for a while."[505] At the time, Ley did not know the details. Von Braun simply disappeared. By this point, Nebel has already succeeded in antagonizing the Ordnance, due to his dual attempts to use their resources for secret experimentation while generating publicity for those same experiments. As Neufeld described, "there was a culture clash between Nebel's blatant self-promotion and the mentality of the officer corps."[506]

Regarding the VfR, Ley remembered, "everything collapsed at once."[507] He would later characterize this year as "the beginning of modern rocketry," due to the activities of engineers Dornberger, von Braun, Grünow, and Riedel.[508] However, at the time, Ley mourned the death of his field of expertise. In his perspective, Nebel had destroyed the VfR. He had also betrayed the cause by militarizing the rocket. "The program of the VfR," Ley claimed, "had been entirely different, it had aimed at the creation of the spaceship as the ultimate goal…"[509] Ley grew intolerant of the Raketenflugplatz. He wanted nothing to do with Nebel, the German army, or military

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[503] Neufeld, *The Rocket and the Reich*, 5-6.
[504] Ibid., 6.
[505] Ley, *Rockets* (1958), 156. In "The End of the Rocket Society, part 2," Ley presents a very inaccurate account of this launch, based on comments from "Count von Braun." He presents a similar account in his 1944 memoir, which claims that one of von Braun's facts is "obviously a lie." See *Rockets* (1944), 152.
[506] Neufeld, *The Rocket and the Reich*, 14.
[507] Ley, "What's Wrong," 49.
[508] Willy Ley, Gallery Proof for *Inside the Orbit of the Earth*, 33.
[509] Ley, "The End of the Rocket Society, part 2," 70-71.

rockets. Simultaneously, key members of the group voiced their ongoing displeasure with Ley's international correspondence. He recalled, "I became known as a 'xenophile,' a man who keeps up correspondence with foreigners."[510] The atmosphere became secretive as rocketry became militarized.

Ley tried to fight these developments. In fact, during the early half of 1932, he spent much time in Berlin libraries, researching ballistics, trajectories, and weapons designs. He was on a quest to scientifically debunk the "war rocket" as promoted by Oberth and Nebel. He recalled, "Both had talked and written a lot about war rockets, and many people had believed."[511] Ley instinctively distrusted their self-serving and opportunistic claims. His "long study" convinced him that "rockets in battle can never be as efficient as guns in battle... the gun is immensely superior in accuracy and at ranges beyond gun range the bombing airplane can carry an immensely superior load."[512] This conviction stayed with Ley for a decade. His long study in 1932 had proved that fact at a time when Nebel did not care about facts. The ineffectiveness of the war rocket was also an obvious lesson of history, which Ley outlined in his 16-page *Grudriß einer Geshichte der Rakete* (1932).[513]

As Ley grew disturbed by the presence of the Army, he also grew increasingly frightened by the domestic and international scene. For example, in the late spring, he opened two copies of the latest editions of *Wonder Stories*. These issues published "The Final War" by Carl W. Spohr.[514] The novel characterized Western culture as relentlessly

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[510] Ibid.
[511] Ibid.
[512] Ibid.
[513] Willy Ley, *Grudriß einer Geshichte der Rakete* (Leipzig: Hachmeister and Thal, 1932).
[514] Carl W. Spohr, "The Final War," *Wonder Stories*, March and April 1932. See also, Frederic Krome, *Fighting the Future War: An Anthology of Science Fiction War Stories* (New York: Routledge, 2012).

addicted to war, at all costs. The novel distressed Ley profoundly. He wrote to *Wonder Stories*, claiming, "I didn't want to write again so soon. I must! I must!"[515] He had spent all day reading the novel. He wrote, "Unnecessary to say it's the best of all war stories… written by a man who saw the hell of the Great War." The story haunted Ley. He recalled: "My thoughts the whole night were: Is there any mistake in the story? No! Is there a mistake in the science or in the technical description of the story? No! Is there a mistake in the description of military and strategic things? NO! Is there a mistake in the idea? Must final war come? Must mankind wipe itself out?"

In a stunning contradiction to his earlier conclusion, Ley wondered, "Maybe some new inventions, like air raids by rockets spreading death over a whole country, will make the biggest danger smaller. Maybe the Conference on Disarmament will help a little." Ley then directly labeled "the owners of factories of guns and ammunition" as war profiteers who would benefit from mass hysteria. "It is said," he added, "the youth are feeling better than the old men… I believe it, but there are sadistic-patriotic types of gun-lovers among the youths. But the youths of each generation can do one thing… war means big business for some men. Well, make an economic situation that war will mean *bad* business. In Europe it can be so, then the crisis will be over." He concluded with a hopeful, yet profoundly naïve comment: "And if men of one nation learn and see enough of other nations, they will lose the idea of war against a nation in whom they have friends… there is a hope." That hope quickly faded by the time that Ley met Hugo Gernsback in June of 1932. Even the "father" of pulp science fiction expressed his urgency. Ley informed Pendray, "He told me, its harder now in America too. Men,

[515] Willy Ley, "The Reader Speaks," *Wonder Stories*, August 1932, 282. Subsequent quotes can be found on this page.

hurry, you are the hope of the world and if you are down long enough, Bolshewism [sic] will eat us all together!"[516]

Soon, Ley lost all hope for both his nation and his field of expertise. After Hitler's seizure of power in January of 1933, the Reichstag burned in February. When a communist was blamed for the fire, mass arrests followed. Certain publications were immediately banned. On the 27th of February, the Reichstag Fire Decree was posted for all Berliners to see. The document suspended a long list of civil liberties, including the freedom of expression, the freedom to assemble, and the freedom of the press. The document also suspended the privacy of postal, telegraphic and telephonic communications. Then, the Enabling Act of March 1933 granted dictatorial powers to Hitler. It also announced that all new laws would be printed in the *Reich Gazette*, set to take effect the day following the announcement. The Gestapo was established in April, and its growing networks of spies and informants must have seemed conspicuous. On April 7, 1933, the "Law for the Restoration of the Professional Civil Service" outlined the immediate purge of all enemies of the state from civil service. It was not long before many scientists and researchers of universities and the Prussian Academy of Science became key targets of the state. As historian Mark Walker summarizes, "The universities and the rest of civil service were being ruthlessly purged of scientists and scholars either racially or politically objectionable to National Socialism."[517] Simultaneously, in April of 1933, the German Student Association demanded "Action against the Un-German Spirit," which soon led to massive book-burnings in major cities

[516] Ley to Pendray, postcard, June 30, 1932, PP, "Ley, Willy 1932."
[517] Mark Walker, *Nazi Science: Myth, Truth, and the German Atomic Bomb* (Cambridge: Perseus Publishing, 2008), 80.

and university campuses. Among the books burned was Lasswitz' *Auf Zwei Planeten*. The Nazis burned Ley's favorite science fiction novel.

During that same month, rocket enthusiast and engineer Rolf Engel (along with a colleague) was arrested and charged with "negligent high treason" for corresponding with foreign engineers. The documents of their Dessau group were confiscated, which seems to indicate that certain Army officials wanted to eliminate competing and public experimentation. As Neufeld explained, "The consolidation of a fascist government committed to the rearmament of Germany and to the elimination of internal dissent presented Army Ordnance with an opportunity to suppress the amateur groups."[518] They "moved quickly to eliminate public discussion and experimentation."[519]

Rudolf Nebel and key members of his group were under similar scrutiny, particularly during and after a bizarre series of events called the "Magdeburg Project." To sum, Nebel promised to launch of a manned rocket, with the goal of proving the "Hollow Earth Theory." Ley later explained the "pseudoscience" behind the project:

> It began like a story by Jules Verne. A mentally decrepit 'philosopher' had written a badly printed pamphlet about the true shape of the universe, in which he insisted that the earth *is* the universe, that we live *inside* a hollow globe of the dimensions of the earth, that there is nothing outside that globe, and that the universe of the astronomers is only an optical illusion. Since every crank can find some fellow cranks, the 'hollow earth philosophy' had found some too…[520]

Thus, a rocket would either confirm or disprove the theory. An engineer by the name of Mengering convinced the city of Magdeburg to pay the bill.

According to most accounts, when Dickhuth-Harrach and Ley heard of plan, while learning of its corresponding advertising schemes to generate publicity for the

[518] Neufeld, *The Rocket and the Reich*, 24.
[519] Ibid.
[520] Ley, *Rockets* (1958), 157.

launch, they drew up a list of charges against Nebel, aimed at expelling him from the VfR. Frank Winter explained, "Among the complaints for dismissal were that he completely neglected his secretarial duties; falsified the ledger; sold articles under false pretenses; failed to pay certain VfR financial obligations… took credit for engineering accomplishments that were never his; and brought 'scientific disgrace' upon the VfR for supporting the 'Hollow Earth Doctrine.'"[521] Although many VfR members and engineers continued their association with Nebel and the Raketenflugplatz, the debacle created a schism between Ley and Nebel, who continued to associate the Magdeburg project with the VfR.

Ley was not simply outraged by the implausibility of the stunt. He was outraged by the "pseudoscientific" theories behind it.[522] It was one thing for a pioneer like Valier to believe in "glacial cosmogony."[523] It was another matter that such nonsense affected the agenda of the VfR. This pseudoscience undermined the scientific cause. It associated spaceflight with cranks. It was far more dangerous to the cause than publicity stunts with powder rockets attached to automobiles.

Ley and Dickhuth-Harrach took Nebel to court. To Ley's dismay, the District Attorney dropped the case for lack of evidence. Ley later explained, "The District Attorney, seeing that Nebel wore a swastika armlet, was afraid to act."[524] According to Ley, "the ensuing conversation ran something like this: 'Herr Major, I hesitate to do anything… I have noticed that he wears a Party Armband [the District Attorney did

[521] Winter, *Prelude*, 45.
[522] In many revisions of *Rockets*, Ley toned down his reflective criticism of the scheme. Most likely, this was due to his close friendship with Herbert Schaefer, who "worked some sixty hours per week on that project." See *Rockets* (1958), 158-160.
[523] See Essers, *Max Valier*. See also, Tom Crouch, *Aiming*, 50-51.
[524] Ley, *Rockets* (1958), 157.

not]… Herr Major, I can only advise withdrawal of your complaints. These are revolutionary times.'"[525]

Nebel's fascist ties saved his skin on more than one occasion. His continued correspondence to England resulted in a Gestapo raid on the Raketenflugplatz.[526] From Ley's perspective, the investigation of the site was quite mysterious: "On one occasion I was not permitted to enter, being told by one man with some insignia of rank on his collar tabs that the Gestapo was there to seize documents and equipment. Possibly a routine investigation took place that day, but if so, I, as vice-president of the VfR, should have been questioned."[527] Ley later recalled his perception of Nazi officers, suddenly intruding into the spaces of the Raketenflugplatz: "As far as we were concerned the 'reborn Germany' consisted of two or three meticulously booted and uniformed young men who gave the impression of being homosexuals. Being of the ripe old age of nineteen or thereabouts they carefully patterned their speech after the Führer's, unless they grew excited and forgot to do it."[528] In later memoirs, Ley removed the derogatory reference to homosexuality.

This episode marked the end of both the VfR and the Raketenflugplatz. Ley recalled: "By Christmas 1933 the picture looked bleak… much bleaker even than it had looked by Christmas 1929. Then it had been mostly a matter of disappointed hopes which could be overcome by hopes for the future. But now it seemed as if there were no way out, with everybody's hands tightly tied by a ruthless totalitarian regime."[529] In

[525] Ley, *Rockets* (1944), 153.
[526] Neufeld, *The Rocket and the Reich*, 26.
[527] Ley, *Rockets* (1958), 160.
[528] Ley, *Rockets* (1944), 153.
[529] Ley, *Rockets* (1958), 161.

Ley's perspective, progress on rockets lay dead in its tracks.[530] Not only had the key organization and test site disappeared, but so too did many of his friends, colleagues, and associates.[531] He would later learn of their absorption into the German Army. Ley was unaware of true extent of the army's consolidation of rocket engineers.

In late 1933, Ley did not immediately give up. He and Dickhuth-Harrach resigned from the Board of Directors. In a December announcement to the ARS, Ley wrote: "We felt obliged to leave the VfR because… Nebel succeeded to bring the VfR down as much as possible to obtain freedom for his own purposes."[532] Ley also claimed that the VfR "had nothing to do with the famous man-carry rocket of Magdeburg."[533] This claim was false. As quoted earlier, Ley had participated in a general meeting of the "Vorstand" of the VfR in 1932. Project Magdeburg had been associated with the VfR from the beginning.

After the split with Nebel, Ley wrote of his intentions of collecting as many VfR members to migrate to a new organization that was "willing and able to follow the line of the VfR before Nebel came into action."[534] By February, Ley claimed success by transferring VfR members into a different organization, called the E. V. Fortschriftliche Verkehrstechnik. Although "it was a difficult and not very pleasant job to clean up the

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[530] Ley, "What's Wrong," 39. In 1940, Ley asks, "Why did progress just stop then?" He answers, "Progress in rocket research has been stopped by the lack of funds and for no other reason!" See Ley, "What's Wrong," 39-40.
[531] In November of 1933, Wernher von Braun joined the Nazi organization that served as an SS equestrian unit. Von Braun later claimed that it was simply a horse-riding club. See Michael J. Neufeld, "Wernher von Braun, the SS, and Concentration Camp Labor: Questions of Moral, Political, and Criminal Responsibility," *German Studies Review* 25 (February, 2002): 59.
[532] Ley to Pendray, December 26, 1933, PP, Box 5, Folder 16, page 1.
[533] Ibid.
[534] Ibid.

whole mess," Ley succeeded in isolating Nebel and effectively disbanding the VfR.[535] He later claimed he was only "pretending" to reorganize the society.[536]

While planning "to make propaganda again" with a new journal, *Das Neue Fahrzeug*, Ley identified himself as "the leading spirit" of the original German Rocket Society.[537] He also wrote to Pendray of his intentions for the EVFV: "it covers the entire technique of vehicles, especially in aviation and rocketry of course." [538] In a different announcement, Ley wrote:

> We are of the opinion, that the ideals and the good old tradition of the VfR shall not be allowed to perish… We are therefore urging you to follow in our footsteps and help us achieve in the EVFV that we were not able to achieve in the VfR because of Mr. Nebel's personal interest; spreading and deepening the idea of rocketry and a scientific, serious advancement of rocket technique, without sensationalism and without unilateral commitments…"[539]

Ley concluded this announcement with the words: "Heil Hitler!"[540] He did not include these words in his announcement to the ARS. Privately, Ley did not mince words about his hatred for Nebel and his tactics. He told Pendray, "Nobody is left of the Nebel crowd. His name means mist or fog… and that's what he is and what he does always."[541]

At the moment when international correspondence became a dangerous activity, Ley kept writing. In fact, he began to plead for greater international cooperation between the American Rocket Society and his newly formed organization.[542] He also

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[535] Ley to Pendray, February 2, 1934, PP, Box 6, Folder 26, page 1.
[536] Ley, *Rockets* (1958), 161.
[537] Ley to Pendray, February 2, 1934, PP, Box 6, Folder 26, page 2.
[538] Ley to Pendray, April 3rd, 1934. PP, Box 6, Folder 26, 1.
[539] Quoted in Winter, *Prelude*, 48.
[540] Ibid.
[541] Ley to Pendray, February 2, 1934, PP, Box 6, Folder 26.
[542] Letter from Cleator to Pendray, March 5, 1934, PP, "British Interplanetary Society, P.E. Cleator – Correspondence."

spread the word about the newly formed British Interplanetary Society, led by chemist Phil E. Cleator. In January of 1934, Cleator visited Berlin, where he spent two days with Ley.[543] Most likely, Ley openly shared information with the British scientist. Despite the arrest of Engel and the surveillance of the scene, Ley also continued to correspond with Pendray about rocket fuels, motor designs, and cooling systems.[544] Talk of combining organizations into a single international rocket society followed.[545]

It was a dangerous time for a scientific internationalist. Frank Winter wrote, "Willy Ley in particular must have felt a great sense of relief at the beginning of 1934. Rudolf Nebel and Project Magdeburg were behind him."[546] While Ley may have felt relieved to begin fresh with the EVFV, it is difficult to imagine him feeling content with the scientific and political landscape. Things only got worse for him in 1934. Amidst the constant redressing of Berlin and its citizens to conform with the designs of the state, Josef Goebbels' Propaganda Ministry issued a decree on the 6th of April. This decree banned discussions of the military uses of rockets, as well as the publication of their technical details.[547] As Neufeld describes, "From the standpoint of the public, rocketry disappeared in 1934 because of the imposition of censorship."[548]

Ley began to plan about his escape. The earliest hint came in an autobiographical note to Pendray, who was researching an article for *New Outlook*. He asked Ley to write biographical sketches of himself, Oberth, Hohmann, Winkler and others. Ley briefly summarized his contributions to the scene of rocketry, after stating,

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[543] Ley to Pendray, February 2, 1934, PP, Box 6, Folder 26.
[544] See Ley to Pendray, June 23, 1933, PP, Box 5, Folder 16, 2.
[545] See, for example, Cleator to Pendray, March 5, 1934, PP, "British Interplanetary Society, P. E. Cleator, correspondence," 1.
[546] Winter, *Prelude*, 48.
[547] Neufeld, *The Rocket and the Reich*, 28.
[548] Ibid.

"It seems to me that I'm the best source of information in the world…"[549] He added the following comment about himself: "Not married, not engaged, want to see the world especially England and America, interested still in movies, like Joan Crawford, don't like Mae West… Is it enough? How I look like you know, it could be blonder for the time being (don't mention the last!)"[550]

Then came the temporary arrest of Nebel, after he had published a pamphlet called *Rocket Torpedo*, which he sent to SA leadership on the verge of the Night of Long Knives. When the Army denounced him to the Gestapo, the SA intervened.[551] Although Nebel escaped the ordeal, the arrest must have frightened Ley further. Following the death of Hindenburg in August of 1934, the "Ordnance now had the power to eliminate even minor irritants."[552] Another spaceflight enthusiast name Werner Brügel had already published a profile of key rocket men in 1933, prior to the ban.[553] In August of 1934, he planned to give a radio talk on the use of rockets for exploration of the stratosphere.[554] The Gestapo raided his residence and confiscated his documents. Although it was an arrest of a minor player, it illustrated the Ordnance's campaign to consolidate rocket development and "to use the mechanism of the Army and the Nazi police state to concentrate development in its own team at Kummersdorf

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[549] Ley to Pendray, May 15, 1934, PP, Box 6, Folder 26, 1.
[550] Ibid.
[551] Michael J. Neufeld, "The Excluded: Hermann Oberth and Rudolf Nebel in the Third Reich," in *History of Rocketry and Astronautics: Proceedings of the Twenty-Eighth and Twenty-Ninth History Symposia of the International Academy of Astronautics*, eds. Donald C. Elder and Christophe Rothmund (San Diego: AAS, 2001): 209-222.
[552] Neufeld, *The Rocket and the Reich*, 31.
[553] Ley had a low opinion of this book and its young author. He told Pendray, "Well, you are absolutely right about the book 'Männer der Rakete'. It is not very good especially not in those parts dealing with the inventors in other countries." Then, Ley added, "Why Goddard was placed in such a prominent position I dont [sic] know. Maybe the young Herr Brügel considered him to be one of the great heros [sic], I don't know." This comment probably angered Pendray. See Ley to Pendray, February 2nd, 1934, PP box 6, folder 26, 1.
[554] Neufeld, *The Rocket and the Reich*, 31.

and to eliminate all possible threats to secrecy."[555] Meanwhile, Ley continued his foreign correspondence. He refused to comply with the demands of the state. Science required internationalism.

Science in Naziland

In Ley's view, not only was scientific progress stunted, but also the nature of scientific thinking came under direct attack. He associated the rise of Nazism with the rise of pseudoscience and public irrationalism. Of course, there was a much longer tradition of reactionary political rhetoric within the German-speaking scientific community. Years before Ley entered the scene of rocketry, conservative and reactionary politics had left its mark on the scientific community. As Mark Walker and earlier scholars noted, "the general theory of relativity was engulfed in an unprecedentedly bitter and sometimes unprofessional debate which had left the realm of science and become entangled with politics and dogma."[556] By 1921, the attack on "Jewish physics" was well underway. Physicist Johannes Stark had attacked Einstein, arguing that he had "betrayed Germany and German science with his internationalism," along with his supporters' tendency to publicize scientific theories through foreign lectures.[557] By 1933, Einstein had become the most infamous symbol for "the 'internationalist' influence which Hitler's movement was determined to eradicate."[558] The physics community by no means fully agreed with this sentiment. In fact, many were "deeply disturbed" by the total coordination of German society following the rise

[555] Ibid., 32.
[556] Walker, *Nazi Science*, 7.
[557] Ibid., 12.
[558] Ibid., 71.

of Hitler. As Walker reiterates, 15 percent of academic physicists emigrated after 1933. John Cornwell argued differently in *Hitler's Scientists: Science, Race, and the Devil's Pact* (2004). In his perspective, it was remarkable how the majority of scientists simply "acquiesced under those pressures."[559] He then quoted historian Joseph Haberer's terminology: "…the scientific leadership engaged in 'expediency and compliance' and colluded with 'victimization of members of the community.'" He added, "Yet some groups – notably doctors and anthropologists – not only acquiesced but took a lead in promoting racist policies, and, in some cases, one segment of the scientific community oppressed and coerced another: experimental physics…" In other departments, the dismissal of non-Aryan professors was widespread.[560] As early as September 1933, Stark advocated for a totalitarian oversight of scientific publications, which matched Goebbels' oversight of media and literature.[561] It was not long before scientific intellectuals began to write textbooks like Philipp Lenard's *Deutsche Physik*, which claimed that everything created by men, including science, could be attributed to blood and race.[562]

In many ways, the Nazi campaign followed a long tradition of scientific nationalism that began during the First World War, before it hardened into a bitter resentment of a "boycott" of German science during the interwar period. A long passage from Mark Walker's *Nazi Science: Myth, Truth, and the German Atomic Bomb* summarized the collective attitude of the scientific community:

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[559] John Cornwell, *Hitler's Scientists: Science, War, and the Devil's Pact* (New York: Penguin Books, 2004), 8.
[560] See also, Götz Aly, Peter Chroust, and Christian Pross, *Cleansing the Fatherland: Nazi Medicine and Racial Hygiene* (Baltimore and London: John Hopkins University Press, 1994).
[561] Walker, *Nazi Science*, chapter 2.
[562] Ibid.

> For the German scientist, the boycott was a moral issue. Their pride had been wounded. They tried to put up a united front and condemned the few deserters like Einstein, scientists who accepted foreign invitations to attend conferences when Germans officially were banned or at least unwelcome. When German foreign policy changed in the course of the Weimar Republic from confrontation to cooperation with the League of Nations and the German Foreign Office turned to German scientists for assistance in reestablishing international ties, the German scientific community refused to cooperate. When Germany was invited to join the International Research Council in 1926, the cartel of German academies and Union of German Universities refused. It quickly became obvious that they simply did not want to join this organization, in large part because of the bitterness caused by the boycott.[563]

After 1933, scientists fled, mobilized to serve the state, or simply tried to co-exist. The internationalists were enemies of the state.

Pseudoscience in Naziland

Although historians will continue to debate about the distinctions between science and pseudoscience, many scholars would agree with Cornwell's description of the rise of pseudoscience in Nazi Germany. He wrote, "In the lethal mix of power, fear, cruelty and dilettantism, pseudo-science began to flourish virtually unchallenged under the auspices of the SS in Hitler's Germany."[564] Cornwell charts how much of the research agenda could be shaped from the top-down, whether pursuits were genetic or anthropological. At the moment when the Army consolidated rocket researchers, Himmler was busy trying to establish the *Ahnenerbe* (Ancestral Heritage), which was a research society focused on holistic science. Cornwell explains: "Apart from its chronic paranoia and sense of injured merit, the Ahnenerbe portrayed itself as breaking down divisions between natural sciences and the arts, and of encouraging a type of 'holism'

[563] Ibid., 108-109.
[564] Cornwell, *Hitler's Scientists*, 191.

that would open up science to the Nazi *Weltanschauung*."[565] Nazi scientists, in turn, were often mixing archaeology and anthropology with mythology, astrology, and the occult.

While it is important to document the role of organizations and the extent to which these activities were state-directed, it is also important to see many of these movements as popular, often flourishing at the grass roots level. This is how Ley perceived a dramatic increase in the popularity of certain doctrines that once occupied the fringes of science. In a later article written for *Astounding Science Fiction*, Ley describes the rise of "pseudoscience" in "Naziland."[566] What follows is a condemnation that blames unscientific thinking for the rise of Hitler: "When things get so tough that there seems to be no way out," he joked, "the Russian embraces the vodka bottle, the Frenchman a woman, and the American the Bible."[567] He continued:

> The German tends to resort to magic, to some nonsensical belief which he tries to validate by way of hysterics and physical force. Not every German, of course. Not even a majority, but it seems to me that the percentage of people so inclined is higher in Germany than in other countries. It was the willingness of a noticeable proportion of the Germans to rate rhetoric above research and intuition above knowledge, that brought to power a political party which was frankly and loudly anti-intellectual. The Nazis did not only burn books they disliked, they also classified theoretical physicists with "Jews and Marxists."[568]

"Small wonder," Ley added, "the pseudoscientists experienced a heyday under such a regime."[569] The pseudoscientists had existed for many years, struggling to achieve some degree of respectability. Now, they flourished amidst the broader embrace of irrational politics and the vulgarization of holism. Of particular offense to Ley was

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[565] Ibid., 192.
[566] Ley, "Pseudoscience in Naziland," *Astounding Science Fiction*, May 1947, 90-98.
[567] Ibid., 90.
[568] Ibid.
[569] Ibid., 90-91.

the popularity of the "Hollow Earth Doctrine" and the "World Ice" theory.[570] These were not legitimate areas of scientific speculation. Instead, they could involve "dream-reasoning fitted into the Nazi philosophy."[571] Most remarkable was Austrian engineer Hans Hörbiger's World Ice theory that "literally had millions of fanatical supporters who would interrupt educational meetings with concerted yelling, 'Out With Astronomical Orthodoxy, Give US Hörbiger.'"[572] People were privileging mystical intuition over empirical knowledge. Their "scientific" movements resembled cults with fanatical and obedient followers, who mimicked their strange leader.

Not only did the pseudoscientists have conformist audiences, they displayed a profound intolerance for dissent. In a letter to Ley, Hörbiger allegedly wrote: "either you believe me and learn, or you must be treated as an enemy."[573] For Ley, it was even more amazing that the public believed such "nonsense," when Hörbiger's publications and letters, "revealed clearly that he was not even a good engineer," let alone a decent astronomical theorist.[574] Unlike a legitimate scientist (in Ley's mind), he based his theories on intuition and visions. Any educated German could "pick flaws in this theory… as easy—and as pleasant—as gathering Japanese beetles from an infested flowerbed."[575] Yet, much of the German public embraced his pseudoscientific ideas, as if they represented a new gospel. Then, within a "powerful popular movement in pseudo-intellectual circles… adherents declared threateningly that now everybody MUST believe Hörbiger, or else."[576] Despite their "scientific" search for the truth, they

[570] Ibid. For an excellent discussion of the World Ice Doctrine, see Cornwell, *Hitler's Scientists*, 193-195.
[571] Ibid.
[572] Ibid., 95.
[573] Ibid.
[574] Ibid.
[575] Ibid., 98.
[576] Ibid.

had become rigid and closed-minded authoritarians. They sought to impose their magical thinking on non-believers. Citizens would be converted, or else.

It is easy to imagine Ley reacting to these events with an instant repulsion toward propaganda, a paranoid state, and the spread of Nazi pseudoscience. Not only were many Germans supporting a mystical, dogmatic, and unreasoning "pseudoscience in Naziland," they embraced an irrational, threatening, and anti-intellectual style of politics. It was as if a mental fog had spread throughout Germany, instantly taking possession of rational minds and a culture that prided itself on its technological and scientific might. Germany had grown spellbound with irrational delusions. Both scientists and scientific fields were under attack from the state. There was no place for sanity or rational science. Progress had stalled.

The Escape

Following the arrest of popularizer Brügel, P. E. Cleator of the BIS received "a rather mysterious communication."[577] An unnamed friend of Ley's smuggled a message out of Germany. Writing to Cleator from Holland, the informant discussed Ley's political problems. Cleator summarizes the information for Pendray: "Apparently there is some trouble brewing in Germany… trouble about which Herr Ley dare not write."[578] Cleator claimed that Ley's mail was being opened and examined. Ley asked Cleator to be very careful and not use any official stationary or envelopes of the British Interplanetary Society. He pleaded for Cleator to pass along the message to the ARS.

[577] Cleator to Pendray, October 30, 1934, PP, Box 6, Folder: "British Interplanetary Society, P. E. Cleator – Correspondence, 1934-1935-1936," 1.
[578] Ibid.

Cleator noted, "'Rocket' is taboo."[579] Then, Cleator received a different letter directly from Ley. Writing to Pendray, Cleator summarized: "He makes no mention of the instructions I received via Holland, but this is only natural."[580] Cleator relayed Ley's inquiry of asking Pendray "if you can think of anyway [sic] in which he could earn some money during his stay in America."[581]

After receiving this information, Pendray wrote to Ley on blank stationary: "It occurs to me that you might have some time this winter to visit America…We have ample room to keep you for an indefinite time and I could think of no greater pleasure than to serve as your host in America."[582] Five days later, Pendray wrote to the American Consulate in Berlin, asking that they grant Ley a visa.[583] Soon, he received a response to an earlier inquiry with the National Council of Jewish Women, which informed him, "The German government… thus far has put no obstacles in the way of those desiring to emigrate. It has, of course, prohibited the taking out of money from Germany which makes it hard for people to emigrate. If your friend has funds… and if he secures a visa from the American Consul, he should have no difficulty in getting here."[584] Pendray wrote an affidavit swearing to be financially and legally responsible for Ley. In a cover letter, Pendray also argued that Ley was "a good friend… the moving spirit of rocket experiments and research in Germany and despite his youth… a man of considerable linguistic scientific and literary achievement."[585] He added, "I am

[579] Ibid.
[580] Cleator to Pendray, November 2, 1934, PP, Box 6, "Cleator correspondence," 1.
[581] Ibid.
[582] Pendray to Ley, November 15, 1934, PP, Box 6.
[583] Pendray to Ley, November 20, 1934 PP, Box 6, Folder 27. See also Pendray to Raymond T. Geist, November 23, 1934.
[584] National Council of Jewish Women to GEP, November 21, 1934. PP, Box 6, folder 26.
[585] Pendray to Raymond T. Geist of the American Consulate, November 23, 1934, PP, "Ley, Willy, 1934," 1. Box 6, Folder 26.

prepared to share my home with him and to provide him with food, clothing and necessary expenses until he can establish himself in this country."[586]

Meanwhile, Ley corresponded with Cleator, attempting to arrange a time and place for his "vacation" to Great Britain, where he would board a ship headed for the United States. In the letters to Pendray, Cleator seemed quite confused by the affair, due to Ley's guarded and cryptic language. "So far as I know," Cleator explained, "he has every intention of returning to Germany after a short while."[587] Cleator added, "But as I understand the matter at present, his leaving Germany is nothing more than a holiday…"[588] Pendray insisted that Ley was trying to escape. After other letters were exchanged, Ley wrote to Pendray: "You are absolutely right and he is equally wrong… I'll never forget what you have done for me. I hope that some day I'll be able to show you how grateful I am."[589]

Ley made arrangements with several newspapers, disguising his "vacation" as a journalistic trip.[590] This may have allowed him to carry several "orders" from different editors. He also made arrangements for a "keg filled with books" to travel separately to Pendray.[591] According to the original plan, Cleator would visit Germany in early January, and Ley would accompany him on his return trip to Great Britain. Unfortunately for Ley, he had problems obtaining a permanent immigration visa. In a telegram sent on January 18th, Ley pleaded with Pendray for a deposit of 500 DMs.[592] After Pendray sent a cablegram to the American Consular Service in Berlin, he received

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[586] Ibid.
[587] Cleator to Pendray, November 29th, 1934, PP, Box 6, Folder 27. 1-2.
[588] Ibid., 2.
[589] Ley to Pendray, Dec. 23, 1934, PP, Box 6, Folder 26, 1.
[590] Ley to Pendray, December 15, 1934, PP, Box 6, Folder 26, 1.
[591] Ibid.
[592] Ley to Pendray, January 18th, 1935, PP, Box 6, Folder 26, 1.

the following reply: "An immigration visa cannot be granted to Mr. Ley because of his serious physical defect (he is practically blind in one eye) and also because he has practically no personal resources and no definite assurances guaranteeing his livelihood in the United States for a prolonged period."[593] If the situation was not desperate, one could imagine Ley joking about being neither blonde enough for the Germans, nor eagle-eyed enough for the Americans.

Nevertheless, Ley remained calm, working with the Consulate to obtain a renewable one-year visitor's visa. Around this time, Pendray wrote a draft copy of a phony letter from a company in the United States. Addressed to Ley, it read: "We have given careful consideration to your qualifications and experience in rocket research, and have decided that you are the man needed to head our proposed progress of rocket development."[594] The letter was unnecessary. Ley obtained a visitor's visa, but it remained to be seen whether he could easily escape the country. On January 30th, 1935, Ley told Pendray, "Now everything is O.K. I've got my visa and I'll get my tickets tomorrow. I'll leave Berlin Sunday next [February 3rd] and go to London first…"[595] He then stated, "An old dream of mine becomes true with this trip and I have you to thank for it… I'll try to cause as less trouble as possible in your house."[596]

On February 3, Ley took a train from Berlin to Düsseldorf, before crossing from Hook of Holland to the English port of Harwich.[597] He had no difficulty crossing the German border. He later recalled, "I could have taken anything I wanted past that guard.

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[593] Douglas Jenkins to Pendray, January 23, 1935, PP, Box 8, Folder 1, 1. See also Ley to Pendray, January 21, 1935, PP, Box 8, Folder 1.
[594] Pendray, "Draft," PP, Box 8, Folder 1.
[595] Ley to Pendray, January 30, 1935, PP, "Ley, Willy, 1935," Box 8, Folder 1, 1.
[596] Ibid.
[597] See Willy Ley, "Von Berlin über England nach New York," *Das Neue Fahrzeug*, March 1935, 17. Reproduced in the appendix of *Die Starfield Company*.

He didn't even search me—just checked to see if my name was on their black list. It wasn't so he let me by and wished me a good trip."[598] As noted by historians Sharpe and Ordway III, with his departure, "the flow of rocket society news virtually ceased—and hardly anyone noticed."[599]

After staying with "Professor" Low for a few days in London, Ley made the journey to Liverpool to stay with Cleator. Together, they sat down to quickly inform Pendray of the news. Cleator summarized the situation, as told to him by Ley: "It will suffice of I [to] say that rocketry (experimentally) is virtually banned in Germany. Brugel [sic] is in a concentration camp, and Zucker has been put in prison. But Willy has got here!"[600] According the Cleator, Ley had a total of "10 marks in his pocket (about 2½ dollars)…"[601] Ley then clarified in his own words: "Things are about as Phil told you, but it is not so bad as it sounds. Please, don't get the idea to publish anything of it, my relations in Germany would have serious trouble… I'll tell you everything personally."[602]

On the day before Ley's departure, Cleator complained to Pendray in a section of a long letter titled "Willy (or Won't He?)."[603] Not only had Ley constantly annoyed Cleator by being unpunctual, but he also took advantage of Cleator's generosity. Cleator claimed, "Willy does not appear to have the slightest idea of the value of money --- or at least of other people's."[604] Cleator compared this rudeness to a characteristic of the

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[598] "Rocket Whiz: Ley's 'Trip' Has Been Good," *Long Island Star-Journal*, November 20, 1959, page not listed on clipping found in the WLC.
[599] Ordway III and Sharpe, *The Rocket Team*, 90.
[600] Cleator to Pendray, February 7, 1935, PP, Box 6, "BIS – P. E. Cleator, correspondence" 1. Cleator wrote a small note, stating that Zucker was now free.
[601] Ibid.
[602] Ley to Pendray, February 7, 1935, 1.
[603] Cleator to Pendray, February 13, 1935, PP, Box 6, 3-9
[604] Ibid., 5.

German "race." He stated, "They seem to take most things entirely for granted. Other nations, it would seem, exist to run around them… Well, I've done all the running around I want to do for a bit!"[605] Cleator then downplayed the urgency of Ley's escape, claiming that he was perfectly safe to continue theoretical work on rocketry. "Willy's only reason for leaving Germany, therefore, is that he wants to experiment. Well, that seems reasonable enough, except that we both seem to have been misled over the whole business."[606] Cleator then expressed his fear that Ley would be an unproductive burden on Pendray. "My only hope," Cleator wrote, "is that he does not prove to be so helpless in America as he has, of necessity, been here… Willy will leave to-morrow from Southampton aboard the Olympic. And in some ways, I must confess, I can't honestly say I'll be sorry."[607]

"Nonsense" and the Death of a "Science" in Naziland

One word characterized Ley's view of the scientific and political scene: nonsense. He had watched many Germans embrace a nonsensical and anti-intellectual regime. He witnessed fellow rocket enthusiasts make nonsensical plans to launch a manned rocket flight to confirm a pseudoscientific theory. He then perceived the transition of a "scientific" field from an open and honest forum of exchange into a secretive world of military oversight, with its corresponding and nonsensical hopes for war rockets. In his view, the state had essentially killed the field of rocketry. There was no hope for the rocket as a wonder weapon. Likewise, there was no hope for an international scientific organization in Germany, especially one that viewed spaceflight

[605] Ibid., 6.
[606] Ibid., 7.
[607] Ibid., 8.

as the ultimate goal of rocketry. The totalitarian state had clamped down on progress. The republic of letters was silenced.

What had begun as a combination of publicity, media, and coordination had ended in failure and politics. Open borders were forcefully closed. Dogmatic conformism replaced the freedom of inquiry. Science and technology had become tools of a paranoid and authoritarian state. The "scientific" field of rocketry had been smothered in blanket of secrecy, restrictions, and laws, just as cosmopolitan Berlin had been redressed in a costume of banners and propaganda.

Under such conditions, there was simply no way forward. Freethinking became dangerous. Imagination became confined to nationalistic fantasies of war and revenge. The international brotherhood of scientists became impossible to maintain. Thus, the fascists had destroyed the very engine that drove science and technology forward. Perhaps the scene would be different in Jules Verne's land of aspiring engineers. After all, the first trip to the moon would take place in Florida, according to Verne.

The Olympic sailed for New York on February 14th. It was the last voyage of the luxury liner. Ley recalled, "She was big and beautiful, but too old."[608] By 1935, such a vessel was obsolete and far too slow. Never would Ley return to Germany.

[608] Ley, "Von Berlin…" 18.

Chapter 4: The Adventures of a Romantic Naturalist

Ley's early years in New York City are revealing for several reasons. This period demonstrates a shift in his ambitions, from an aspiring publicist of a rocket society to an aspiring science writer with broader interests. Whereas Ley initially tried to replicate the earlier successes of the VfR through public demonstrations and organizational ties, he soon changed tactics to suit his new environment in the broadcasting and publishing capital of the United States. At the same time, he continued to branch out from the subjects of rockets and space travel, when opportunities arose. Although he continued to write about rockets, most of his works contained broader and more general celebrations of science, the complexities of nature, and the frontiers of exploration. Ley continued to research and popularize natural history, which still delighted American audiences. His related histories of other scientific fields, particularly astronomy, adopted an increasingly historical focus.

He broadened his scope in the pages of pulp magazines, as well as in books aimed at popular audiences. He also became a public educator and recognized "scientist," in spite of his profession as a writer. Thus, his ability to navigate the media environment of New York City can teach historians about the rise of a public intellectual, as well as the increasing opportunities for a science writer during the late 1930s. Ley's career demonstrates how a writer (outside of an institution or laboratory) can become a "foremost authority" of a scientific field.

Additionally, Ley's early years in the United States represent a political turn toward a "scientific left," particularly within his science fiction stories and more general histories of science. As Ley used "scientifact" articles and fictional stories to promote

an anti-authoritarian image of the scientist, he also became more politically outspoken. He participated in what could be called a "popular science front" that increasingly transitioned from a fight against fascism into a war against the "authoritarian mind." In fact, his science fiction stories reveal an increasing hostility to both fascism and communism, as well as a tendency to group these movements together under the label of totalitarianism. As this chapter will demonstrate, his anti-totalitarian views influenced his fiction and non-fiction, especially his general histories of science.

Many intellectuals shared his perception of dictatorship as democracy's opposite. This collective understanding is explored most directly in Benjamin Alpers' *Dictators, Democracy, and American Public Culture*.[609] Alpers demonstrates how perceptions of totalitarianism solidified prior to the Cold War, when it became common to lump communism and fascism together as the same political monster under different masks. He also shows how anti-fascism flourished in populism during the 1930s, before later cultural critics would further associate totalitarianism with mass culture and broadcast media. Alpers argued: "'Totalitarian' and 'Totalitarianism' came to be associated both with the equation of communism and fascism and with the crowd-based understandings of the regimes in question."[610] While these associations became particularly hegemonic during the Cold War, Alpers argues, "the roots of Cold War political culture go deeper into America's past than we often suppose."[611]

In some ways, Ley fits well into Alpers' camp of "cultural producers" who influenced a broader public. Like many Americans, Ley's political identity was shaped

[609] Benjamin Alpers, *Dictators, Democracy, and American Public Culture: Envisioning the Totalitarian Enemy, 1920s-1950s* (Chapel Hill and London: The University of North Carolina Press, 2003).
[610] Ibid., 12.
[611] Ibid., 13.

"largely in opposition to modern dictatorship."[612] Over the next decade, he would gradually emerge as an influential figure, who communicated his anti-authoritarian beliefs to a mass audience. In other ways, Ley is an interesting example of a cultural producer who used mass media to voice his anti-authoritarian beliefs during the late 1930s and beyond. He associated communism and fascism with the spread of irrationalism and pseudoscience. Yet, Ley never blamed popular media or the inherently passive audience. Instead, he embraced mass media, while never losing faith that the vast majority of people could make informed, rational, and fundamentally scientific decisions, if they had been trained to do so. They needed to learn to think scientifically about the world. They needed an expert who helped them to see for themselves. The science writer could fulfill this role, not as a dictator of facts, but as a teacher who inspired critical thinking and independent thought. During the 1930s, Ley's audience was more limited to certain niche magazines and a few broader publications. Nevertheless, as this chapter will demonstrate, Ley's anti-totalitarian and pro-scientific views would converge in many interesting ways. Like other influential figures, he worked to shape American political culture.

Ley's activities and perspectives reveal important aspects of anti-totalitarian discourse that are often absent in Alpers' account: how representations of science and the self-representations of scientists were also shaped in opposition to a totalitarian "other." In the view of many scientific intellectuals, the key distinction between totalitarian crowd-psychology and rational democracy rested in the public's embrace of scientific thinking. Communicating the "scientific spirit" in popular realms became a tactic to preserve democracy and science from the perceived opposites of totalitarianism

[612] Ibid., 1.

and "pseudoscience." The "pseudoscience wars" were central fronts in their campaigns.[613] Arguably, Ley's shift from a specialized subject to a broader popular front was not a unique career change for many scientific intellectuals. This chapter concludes by connecting Ley's career to a broader group of scientists and intellectuals. Later chapters will take these connections further, thus suggesting the widespread nature of certain beliefs and perceptions of the totalitarian "other."

A Prophet Seeking Honor

February 9th, 1936. Willy Ley was ready to launch a rocket plane. Ideally, the vehicle would soar 400 yards from Greenwood Lake, New York to cross the New Jersey state line. If he succeeded, then he could take credit for the first rocket plane flight in the United States. It might later be hailed as "the Beginning."[614] According to plans, the "airplane models should be projected from the catapult at an angle of twenty-three degrees, thereby attaining flying speed. Then the rocket motor was to let the model climb under the same angle for about thirty seconds, covering distance, and gaining altitude at the same time."[615]

Ley hoped that this demonstration would generate interest in rocketry, which, in his view, was sorely lacking in the United States. He later recalled his initial surprise at this situation. In spite of a flourishing niche market for science fiction media, "the idea of spaceflight was by no means popular yet, especially in the United States."[616] There

[613] Much more will be said that relates this argument to the works of other scholars, including David Hollinger, Andrew Jewett, and Michael Gordin.
[614] Ley, "Eight Days," 64.
[615] Ibid., 63-64.
[616] Willy Ley, *Events in Space* (New York: McKay Company, Inc., 1969), 22.

had been few concerted efforts to excite audiences about a future of Americans in space. Ley recalled that scientists like Goddard "were told to take their science fiction plots home with them."[617] Rockets were the stuff of *Buck Rogers* and *Flash Gordon*. With the flight of the first American mail rocket, Ley hoped to reverse this public perception. He hoped that the tactics of Weimar advocates would work in a new setting.

Ley also hoped to better his situation as a refugee in the United States. Ley's first year had not been easy. When he arrived in the United States in February of 1935, he went to Jones Beach to study the Horseshoe crab.[618] One could imagine him marveling at the creature, while pondering his situation as an impoverished refugee, homeless and jobless. Luckily, he had the support of G. Edward Pendray of the American Rocket Society. During the next five months, Ley stayed with Pendray in Crestwood, New York, where he participated in the experiments of the American Rocket Society. Ley also contributed to its journal, as well as other publications. For example, Ley wrote "The Story of European Rocketry," which appeared in the October edition of *Astronautics*.[619]

However, Ley soon distanced himself from both Pendray and the ARS. There may have been personal fallout. Regarding the ARS, Ley later recalled that they were "imitating" the German Rocket Society. Although the ARS "did progress to actual experimentation... that financial vicious circle… caught it even more rapidly than it

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[617] Ley, "Moons and Missiles: Space Science Pleas Ignored," *Los Angeles Times*, November 18, 1957, 14.
[618] "Ley, Willy," *Current Biography*, 1941, 513.
[619] Willy Ley, "The Story of European Rocketry," *Astronautics*, October 1935. This article was a dry account of the VfR and its experimental progress. It lacked many of the personal details of Ley's later memoirs. With the help of Cleator, Ley also reported on the "The Rocket Controversy" for *Armchair Science* in April of 1935. This article boasted the case for liquid fuels while again dismissing powder rockets as the "plaything of a pyrotechnist." See P. E. Cleator and Willy Ley, "The Rocket Controversy," *Armchair Science*, April 1935, 19. Also in the PP, Box 4, Folder 16, "Rockets – Articles and Journals of Foreign Rocket Groups, 1932-1949."

caught the German Society…"[620] He concluded: "I have to state, however, that I do not believe that a Society, unless backed by a few wealthy and very generous members, has a chance to progress much further than the German Rocket Society did."[621] The ARS would need 20,000 members when "It seems that there are not 20,000 people in the world that know enough about rockets and think enough of the importance of rocket research to support such a society for a number of years."[622] By 1943, he was convinced that the ARS was not the path forward: "The more time I have had to think about it the more have I arrived at the conclusion that the VfR progressed as far as any society can progress… Experimentation had reached a state where continuation would have been too expensive for any organization, except a millionaires' club."[623]

In 1935, Ley probably expressed similar views, which would have angered Pendray. By June, Ley was staying elsewhere. He wrote a somewhat formal letter to Pendray, informing him of his departure from Crestwood to stay with the van Dresser family in New York City.[624] He also informed Pendray of his difficulties in finding office work, with the assistance of the Committee for German Refugees. Ley's tone was apologetic and thankful: "But I will not miss the opportunity of this letter to thank you very much for all you have done for me. I enjoyed the time I was staying with you very much and I will never forget it."[625]

Whereas the ARS could not further the cause, an investor could. Ley had begun his search in April, and he found a dealer of stamps named Frido W. Kessler. Ley

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[620] Ley, "What's Wrong," 49.
[621] Ibid.
[622] Ibid., 145.
[623] Quoted in Sharpe and Ordway III, *The Rocket Team*, 20.
[624] Ley wrote, "All my activities take place in N.Y.C." Ley to Pendray, June 23, 1935, PP, Box 8, Folder 1
[625] Ibid.

persuaded Kessler to invest in public demonstrations of rockets.[626] Pendray explained Ley's plans: ""[I]f his plan goes through Ley will be the chief engineer of the project, which as it is now lining up will be a most ambitious and worthy one. Needless, to say, the whole business is now confidential."[627] Ley and Kessler made a three-year agreement to conduct public experiments with "mail carrying rockets." While Ley would design and build rockets, Kessler would control the publicity of the spectacles, as well as the production of stamps and postcards. The costs of these launches would be defrayed by selling these souvenirs after they had been mailed by rocket. Aviation expert Stan Solomen described the business venture: "collectors could order either a 75-cent envelope or a 50-cent postcard, many of which were autographed by Kessler and Ley."[628] The first launch was scheduled for February 9th, 1936 near Greenwood Lake, New York. Kessler's newly formed Rocket Airplane Corporation of America sponsored the flight.

Ley's mail carrying rocket plane was dubbed "Gloria." On the day of the first flight, "Gloria" was revealed to the public, which consisted of a few journalists as well as a crowd of 500 onlookers, who braved the bitter cold for several hours. Solomon described "Gloria" for the readers of *Air & Space* magazine in the 1990s: "Except for the graceful curve of the lower fuselage, the craft had not the slightest suggestion of streamlining. It resembled a giant version of a crude free-flight model airplane."[629] A reporter at the time described the plane as a crude "flying fish with its flat belly."[630]

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[626] Pendray to Harry Bull, April 10, 1935, PP, Box 8, "Pendray – Correspondence Harry Bull – Rockets, 1935."
[627] Ibid.
[628] Stan Solomon, "Oldies and Oddities," *Air & Space*, December 1993/January 1994, 87.
[629] Ibid., 86.
[630] "Rocket Plane Fails to Soar After Take-Off: Freezing Fuel is Blamed as Mail Experiments Prove Futile," *Washington Post*, Feb. 10, 1936, 3.

Most of the materials used in the construction of "Gloria" were bought at a local hardware store. Despite its amateur-looking design, it contained "the most powerful explosive mixture known to man," according to the press. It also carried 6000 letters and postcards.

Ley had prepared for months. He had made numerous experiments with the motor, and initial tests "proved to be worthwhile."[631] Not only did Ley's motor fire consistently on a test stand, but also all plans for the glider flight had been "nicely calculated, checked and rechecked."[632] The weather was the most notable obstacle, after blizzards had created several delays. On February 9th, Ley was ready to dazzle the public with the first flight of "Gloria." He hoped to establish himself as a promising rocket engineer. His future prospects rested on the outcome.

After the police pushed the crowd to a safe distance, other factors delayed the launch, until Kessler finally "tested the wind and gave the signal." "Let it go," he yelled. Dressed in a safety suit, Ley approached "Gloria" with a small torch to light the rocket exhaust. He then jumped back, waiting for the rocket to soar into the air, with the assistance of an angled catapult. The rocket performed poorly and the catapult did not fire. "Gloria" spent several seconds immobile on the catapult before building up enough thrust for 3 seconds of slow ascent that ended with a belly flop. After the crowd waited another 30 minutes for a refueling, a second attempt was made. Although the engine performed better and the catapult worked, the plane "slid clumsily into the air," before a somersaulting to the ground, well short of the state line.[633]

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[631] Will Ley, "Eight Days," 63.
[632] Ibid.
[633] In "Eight Days in the Story of Rocketry," Ley presents a very different version of these events. See Ley, "Eight Days," 63. In later versions of *Rockets,* he did not recount the events of these days.

Kessler postponed a third attempt. A reporter described the scene: "After this four-hour wait in a bitter wind," the disappointed crowd dispersed, offering "grumbles and disparaging remarks."[634] The reporter went to near-by Heidelberg Castle, where he talked with a former officer of the British Royal Air Force. This military-minded man mused about the application of rocket technology in a future war. In his estimate, "rockets could be sent thousands of miles by radio control, laden with explosives or gas… They would crash head-long into densely populated cities which would have no defense." Ley did not share his views about the military potential of "Gloria." He avoided reporters.

A second attempt was made after Ley and several members of the American Rocket Society "tore the rocket assembly apart, readjusted the motors, replaced the feed lines, installed a new valve releasing mechanism."[635] After several encouraging tests, the second attempt was made on February 23rd. Most likely, there were far fewer spectators braving the cold to witness the event. Press coverage was minimal. Nevertheless, Ley and Kessler staked a claim of grand success, after one rocket plane rose sharply before crashing, while a second plane simply slid over the ice, before briefly becoming airborne and then crashing at a distance of approximately 800 feet.[636] The *Chicago Daily Tribune* reported: "More than 6,000 pieces of mail were carried across the New York-New Jersey state line today by two rocket propelled airplanes making short flights claimed as the first of their kind… Fred Kessler termed the experiment 'successful.'"[637] With regard to his motor, Ley agreed: "As far as the rocket

[634] "Rocket Plane Fails to Soar," 3.
[635] Ley, "Eight Days," 63.
[636] Ibid.
[637] "Two Rocket Plane Flights are Hailed as First Success," *Chicago Daily Tribune*, February 24, 1936, 9.

motors were concerned, they have to be regarded as successful."[638] For "the story of rocketry," the Kessler flight was a day of "special importance."[639] In Ley's words, it outshined the "flights of Dr. R. H. Goddard in this country and by Johannes Winkler in Germany."[640]

Although Ley claimed success, he discontinued his association with Kessler in the spring of 1936. In July, he informed Pendray of his difficulties of finding other work as an engineer. "I feel very sorry indeed," he wrote, "that I did not succeed yet to pay back the money you advanced me when I came to this country… As you are doubtless aware I am not allowed to do other than professional work (which amounts practically to free-lance writing with occasional and badly paid lectures)…"[641] According to Ley, the Kessler stunts also resulted in a net loss, although it helped to form connections. Otherwise, Ley barely made enough money to cover the cost of living.

In October of 1936, *Popular Aviation* reported on Ley's alleged progress with altitude rockets: "A series of rocket altitude shots—the first of their kind in this country—is planned by Mr. Willy Ley, associate of the famed Professor Oberth, pioneer rocket theorist."[642] Ley was further innovating the one-stick "repulsor" rockets, designed with a new cooling system. Ley planned to make a first attempt to reach 10,500 feet. The magazine reported, "the promise of complete success is very great, as this experiment will be almost identical to others which he made while in Europe."[643]

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[638] Ley, "Eight Days," 64.
[639] Ibid., 63-64.
[640] Ibid., 64.
[641] Ley to Pendray, July 27, 1936, PP, "Ley, Willy, 1936, Box 8, Folder 22.
[642] C. W. McNash, "Proposed Altitude Rocket Hops," *Popular Aviation*, October 1936, 7.
[643] Ibid.

The next step involved launching a rocket from an elevation of 3 miles, so that it could reach a height of ten miles above sea level.

This article also claimed that Ley had just finished writing his first book in English, called *The Attack on the Stratosphere*. It apparently outlined the next step in progress: meteorological rockets that collected data about the upper atmosphere. This scientific endeavor would be followed by the "mail rocket," which "would attain terrific speeds in the rarefied stratosphere and would be used to deliver mail across the continents or oceans in less than an hour."[644] Next came the space rocket "far in the future, perhaps, but sure to come, bearing with it staggering possibilities."[645] "The weather rocket," Ley backtracked, "is, however, an immediate possibility…of not more than a year's work and of less an expenditure of money than the price of a large passenger airplane."[646]

The Attack on the Stratosphere did not find a publisher, and very little is known about Ley's continued experimentation with rockets. Most likely, he hoped that a new patron would come forth, recognizing the value of his plans. Yet, no one came forth to finance these proposed experiments. Ley's further attempts to promote rocket experimentation met with skeptical audiences. For example, in a later article for *Startling Stories*, Ley recounted a hostile audience of engineers in 1936.[647] Not only was his talk continuously interrupted by skeptical individuals, but also the audience members made outlandish statements, such as: "All this is nonsense anyway. A rocket can't work in empty space. What has it got to kick against?" Ley expressed his

[644] Ibid.
[645] Ibid.
[646] Ibid.
[647] Willy Ley, "The Road to Space Travel: Part 1," 73.

astonishment at the unimaginativeness of American engineers. He wrote, "Thus the meeting ended with a round of drinks and general head-shaking. The drinks, I seem to remember, were good."[648]

Meanwhile, Ley experienced a personal crisis as his visitor's visa expired. He could neither obtain a second renewal as a German refugee nor could he obtain a permanent visa. Ley was terrified of the possibility of being sent back to Germany. Perhaps he received advice from the Committee for German Refugees. Or, he may have learned of a solution from other immigrants. They resolved the problem by leaving the country and re-entering as Cuban refugees.

The venture was risky and expensive. Ley had few resources. In what was perhaps a desperate attempt to shift gears and earn money, Ley wrote several science fiction stories, while sending off many fact-based articles to Campbell's *Astounding Stories*, as well as *Thrilling Wonder Stories*.[649] Ley had always been a fan of these pulps. He had also been writing letters to *Wonder Stories* since 1930.[650] He also appreciated traditions that began with Hugo Gernsback's desire to "promote a participatory vision of democratic science…"[651] When Ley could afford to buy the pulps for 15-25 cents, he did. Yet, prior to this moment of personal crisis, he had kept a distance, still hoping to establish himself as an engineer. Now he was willing to associate his name with the pulps, while writing science fiction under the pen name of

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[648] Ibid.
[649] See, for example, Willy Ley, "The Dawn of the Conquest of Space," *Astounding Stories*, March 1937, 104-110. Other articles included "Visitors from the Void," March 1937; "Fusible Alloys," July 1937; "Power Plants of Tomorrow," January, February, and March 1938. Some of Ley's 1938 contributions to *Astounding* may have been written in 1937. See "Witnesses of the Past," June 1938; "Orbits, Take-Offs, and Landings," August 1938. For Ley's articles in *Thrilling Wonder Stories*, see "Eight Days in the Story of Rocketry," December 1937; "The Conquest of the Deep," June 1938.
[650] His letters appeared in *Wonder Stories* in September and December of 1930, January of 1931, and January and August of 1932.
[651] Cheng, *Astounding Wonder*, 53.

"Robert Willey." He always claimed to have used a pen name simply to distinguish his fiction from non-fiction, rather than hide his identity. This claim is plausible, because editors made little effort to disguise his identity.

"At the Perihelion"

Ley's first science fiction story reveals his state of mind during his visa crisis. It detailed the Martian adventures of Dan Benson. In a bizarre analogy to his own visa problems, Ley described Benson's struggle to fill out an application of "Retainment of Terrestrial Citizenship." Benson had no intention of losing his American citizenship and being forced to reside in Soviet territory on Mars. The application is described as "a document of exceptional length" and "a cross between an American income-tax return, a German *Fragebogen* as to Aryan or non-Aryan ancestry and a G.P.U questionnaire for prospective members of the Russian communist party."[652] The story adds: "It was a light year of red tape." Although Dan was "a college graduate, a well-known writer, and a specialist in some scientific lines," he could not make heads or tails of governmental red tape.

By trade, Dan was a journalist and science writer exploring the Martian landscape: "It was about a thousand days that he had lived like a hermit in the Martian desert. One thousand days of hunting knowledge, hunting treasures… and pounding the typewriter."[653] At this point, "he caught himself wishing to meet a girl."[654] During a

[652] Robert Willey, "At the Perihelion," *Astounding Science-Fiction*, February 1937, 44.
[653] Ibid. 46.
[654] Ibid. Although the exact details are unknown, Ley briefly married his first wife during this time. According to most accounts in the autobiographies of science fiction authors, the marriage was unhappy and brief. It is also possible that Ley briefly married the German refugee to assist with her visa status.

meeting with governmental officials, Dan met a girl, described as "a beauty. Just a beautiful Russian girl… with large gray eyes… [and] dark-blond hair in beautiful curls."[655] The Soviet official began the meeting with these words:

> You are American, thirty-six, studied astronomy in America and have a German doctor's degree in chemistry. Your profession is that of a writer on science matters. You were professor of astronomy at Columbia University and planned to marry about three years ago. Suddenly you resigned from your post, did not marry and went to Mars. Since then you were a fairly successful gem digger and a successful author.[656]

The Soviet adds, "Occasionally you write stories under the pen name of Herbert H. Harr."[657]

The only way for Benson to avoid becoming a Soviet subject is to work as a contractor for the Soviets. The job involves exterminating the blue "skolopenders," which are deadly reptilian-like creatures that suck the moisture out of a human's body. The young woman, Miss Nadya Tcherskaya, is sent with him as his G.P.U. supervisor. As Dan learns more about her, he grows very intrigued. She is not a typical Russian woman. "Where did you learn English?" he asked. "Fifty-Seventh and Broadway, mister," she answered, "I lived there for three years… My chauffeur was a Negro from Florida, which added flavor."[658] As Benson studies her more closely, he could not help but fall in love: "She was so beautiful; there was no doubt about her intelligence. Suddenly, he stopped the drift of his own thoughts. He must stop thinking about her; he must never again start dreaming around her; she was—the most undesirable girl to fall

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Passenger records from Havana, Cuba in 1938 reveal a woman named Margot Ley, whose husband is listed as "W. O. Ley" in Jackson Heights, New York City.

[655] Ibid., 47.
[656] Ibid.
[657] Ibid.
[658] Ibid, 49.

in love with."[659] As an intelligence operative, her mysteriousness and political savvy increase as the story progresses.

Much of the remainder of tale narrates their joint adventure in exterminating the "blue menace."[660] On the one hand, it is an adventure tale that involved exploration through the ruins of an ancient Martian civilization. Like Ley's earlier *Die Starfield Company*, the leading female character is the most complex and exotic. The tale is essentially a love story. On the other hand, it is a nightmare of forced conscription under Soviet leadership. At one point, when Benson reports for duty, an officer asks, "Comrades… this is war. An enemy threatens the prosperity of Soviet territory. That the enemy is not human does not matter. It is war. But you may tell me who is too ill for duty."[661] Those who stepped forward are killed by the state. Others continue to live as slaves. Benson wonders when the slaves would turn their flamethrowers against their own tanks.[662]

Before long, Benson is convicted of treason for failing to remain on schedule regarding the extermination of the "blue menace." While he waits for the red tape to be cleared for the execution of an American citizen, Nadya saves him, as the Soviet zone on Mars descends into open rebellion and chaos. Workers revolt and armies fight each other. Dan and Nadya escaped the Soviet zone via rocket. Their first plan to land in other zones is thwarted by new laws forbidding the spread of anarchy outside of the Soviet zone. Their only chance involves a trip back to Earth, in a path that takes them incredibly close to the sun. The last seven pages describe this harrowing space

[659] Ibid.
[660] Ibid., 56.
[661] Ibid., 57.
[662] Ibid., 58.

adventure of survival in the extreme environment of a spaceship. When they finally reach the earth, Dan and Nadya marry in the United States. They lived happily ever after. The Soviet nightmare is over.

"Scientifact" and Science Fiction Pulps

Editor John W. Campbell paid Ley $235 for "At the Perihelion," along with another $185 for three factual articles.[663] Soon, Ley left for Havana, Cuba. Virtually nothing is known about Ley's time in Cuba, other than he returned through Miami, Florida on February 3rd.[664] When he arrived back in New York City, the situation may have been desperate. Now, he would rely on the science fiction pulps for more than entertainment. They became a lifeline, as he made a "precarious living" as a writer.

Some of Ley's earliest articles related to his recognized expertise as a rocket expert. For example, *Astounding Stories* was the first to publish a short non-fiction article named "The Dawn of the Conquest of Space."[665] Soon, *Thrilling Wonder Stories* also proclaimed Ley as "World's Foremost Authority" on rockets, when it published his "Eight Days in the Story of Rocketry," in December 1937.[666] A later article for *Astounding Science Fiction* also speculated on a "Space War." Ley argued that the "rays, ray screens, and all super-potent weapons of science-fiction aren't half as deadly as a weapon we already have!"[667] Other articles included "Visitors from the Void,"

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[663] This information comes from Ley's records of income received for specific articles in the late 1930s and early 1940. See WLC, Box 4, Folder 2.
[664] Willy Ley, "Petition for Naturalization, no. 449397," obtained from the National Archives at New York City.
[665] Ley, "The Dawn of the Conquest of Space," *Astounding Stories*, March 1937, 104-110.
[666] Ley, "Eight Days," *Thrilling Wonder Stories*, December 1937, 56-64.
[667] WL, "Space War," *Astounding Science-Fiction*, August 1939: 72.

"Stations in Space," and "Calling All Martians!"[668] For *Amazing Stories*, Ley wrote a seven-part exploration of the solar system.[669]

Ley accepted the title of "World's Foremost Authority" on rockets and space travel at precisely the moment when G. Edward Pendray was writing for magazines, such as *Sky* and *Scientific American*.[670] Whereas Pendray's article, "Number One Rocket Man" glorified the contributions of Goddard, Ley's "Eight Days in the Story of Rocketry" only briefly mentioned Goddard. In Ley's article, Goddard did not deserve his own day in history of rockets. Instead, Ley highlighted the contributions of Ganswindt, Oberth, Valier, and himself. At this point, Pendray likely viewed his competition with Ley as a struggle to preserve the legacy of an American inventor.[671]

Some historians may be tempted to focus on Ley's histories of technology and his promotion of rockets in the pages of science fiction pulps and other magazines. After all, Ley's sole claim to fame lay in his earlier association with the VfR and his role as a rocket expert. Yet, it is important to note that the majority of his freelance writing between 1937 and 1941 displayed a much broader interest in the histories of science, technology, and exploration.[672] Ley was continuing to branch out. He was becoming a professional science writer.

This branching out soon exploded in the non-fiction sections of science fiction magazines. Examples included a history of geology and continental drift called

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[668] WL, "Visitors from the Void," *Astounding Stories*, May 1937: 91-98; "Stations in Space," *Amazing Stories*, February 1940; "Calling All Martians!" *Thrilling Wonder Stories*, November 1940; See also a three-part series called "Power Plants of Tomorrow," *Astounding Stories*, January-March 1938.
[669] See *Amazing Stories*, 1940.
[670] See G. Edward Pendray, "To the Moon via Rocket?" *Sky*, November 1936.
[671] Eventually, this feud would grow out of control, as Pendray accused Ley of a German conspiracy to overshadow the legacy of Goddard.
[672] Ley was billed as the "World's Foremost Authority" in the December 1930 issue of *Thrilling Wonder Stories*, cover.

"Geography for Time Travelers," a history of "Earth's screwy plants!" titled "Botanical Invasion," an analysis of massive engineering projects labeled "Atlantropa—The Improved Continent," and even a speculative piece about "The Kitchen of the Future."[673] It was also common for Ley to speak of the "The Conquest of the Deep," in several factual and historical articles about oceanic exploration.[674]

Additionally, Ley earned a better income by writing articles for natural history publications, including *Frontiers*, *Fauna*, and *Natural History Magazine*. Examples included "Legend of the Unicorn," "Zoology of Wonderland," "The Return of the Urus" and "First Mention of the Giant Squid."[675] Ley had several goals while writing these historical articles. Foremost, his income was stabilizing. Whereas the science fiction pulps typically paid about $15-$20 per article for non-fiction, magazines like *Esquire* paid as much as $112.50.[676] On a more idealistic level, he wanted to encourage readers to share in his own love of exploration. In a guest editorial that concisely outlined his advice for science fiction fans, Ley pleaded, "See Earth First!"[677] He continued, "It is one of those pet beliefs of very many people nowadays that there is nothing left to

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[673] Willy Ley, "Geography for Time Travelers," *Astounding Science-Fiction*, July 1939, 122-134; "Botanical Invasion," *ASF*, February 1940, 91-100; "Antlantropa—The Improved Continent," *Modern Science Stories*, February 1939, 99-104; "The Kitchen of the Future," *Thrilling Wonder Stories*, October 1939, 96-98. See also: "Ice Age Ahead?" *ASF*, February 1939, 86-95; "The Ersatz World," *Super Science Stories*, May 1940. 118-127; "Galileo's Revolution," *Super Science Novels Magazine*, August 1941, 100-103.

[674] Willy Ley, "The Conquest of the Deep," *Thrilling Wonder Stories*, June 1938, 36-48; "See Earth First!" *Startling Stories*, July 1939, 13; "Sea of Mystery," *Astounding Science Fiction*, June 1943, 97-108; "Death Under the Sea," *ASF*, September 1942, 44-53.

[675] Willy Ley, "Legend of the Unicorn," *Frontiers*, June 1939; "Zoology of Wonderland," *Frontiers*, February 1941; "The Return of the Urus," *Fauna*, February 1940; "The First Mention of the Giant Squid," *Natural History Magazine*, December 1940. As recorded in his ledger, other titles of articles included, "Romance of the Third Dimension," "Great Unknown of the Seas," "The Strangest Animals," "The Return of a Native," "Conrad Gesner was Right," "Conquest of the Air," "Story of the Barracuda," "Dragon of Lias Epsilon," and "Animal Legends." This list is a small sampling of his titles for various magazines.

[676] For a ledger of Ley's recorded article sales during this period, see WLC, Box 4, Folder 2.

[677] Ley, "See Earth First!" *Startling Stories*, July 1939, 13.

explore or to discover—excepting, of course, discoveries that can be made in physical and chemical laboratories and those that are in the realm of astronomy."[678] For Ley, it was simply bizarre that so many educated individuals believed that "On Earth the job is done."[679] Ley continued:

> Those that hold and voice this belief learn with almost a shock—and plenty of incredulity—that the surface of the Moon (meaning the four sevenths of it that we can see) is better known than the surface of our world… The why is obvious, we see the surface of our satellite from quite a distance and we therefore see it always as a map while even stratosphere balloons do not possess enough elevation to see large portions of the Earth the same way… We will have to wait for rocket ships...[680]

Nearly "one fifth of the land surface of the Earth is still unexplored," Ley wrote, adding, "On every continent—excepting only Europe—there are vast stretches of land that are either completely unknown or have been traversed only by the weary, worn-out, and fever-stricken explorers." Ley bolstered his case by stating how little human beings know about oceanic life. As a guest editorial in a pulp of fantastic stories, Ley tried to bring readers back down to earth: "We are now eagerly reaching out for the planets, at present in science fiction and in theory, a few decades hence in actuality. But in the meantime, before we are all ready to go out to discover other worlds, we have a job waiting: to finish discovery at home."

In his own unique way, Ley participated as a rebel outside of the ranks of institutional science. He shared certain aspects of the scientists within historian Katherine Pandora's *Rebels within the Ranks*, which charts a group of psychological theorists who grew "disturbed by triumphalist pronouncements that seemed to be

[678] Ibid.
[679] Ibid.
[680] Ibid.

closing off debate…"[681] Although Pandora is documenting a very different context and group of historical actors, some of her general claims could apply to Ley. Like others, Ley "rebelled against restrictive definitions of what properly constituted the boundaries of scientific life."[682] Ley still offered a restrictive view of proper, empirical science, yet he did so in a way that celebrated the "borderlines," the unexplored, and the great unknowns. He also promoted an interdisciplinary sensibility that contested what he viewed as a stubborn and unimaginative status quo of scientific skepticism. Natural history and exploration served as fruitful alternatives to classical physics and laboratory practices. In some general ways, Ley also promoted "a form of 'experiential modernism,' that is, a search for scientific forms of knowing that would unsettle conventional ways of thinking without simultaneously divorcing reason from feeling, and thus from the realm of moral sentiments."[683] Overall, he promoted the explorer as a scientific hero who embarked upon a journey into the great unknowns of nature. Scientists were still romantic heroes.

The Search for Zero

Not only did Ley use these publications to promote a sense of wonder for the unexplored, but also he also defined science in a way that celebrated the history of science. From his perspective, some of these accounts were boldly revisionist. For example, in a two-part article called "The Search for Zero," Ley summarized both

[681] Katherine Pandora, *Rebels within the Ranks: Psychologists' Critique of Scientific Authority and Democratic Realities in New Deal America* (Cambridge: Cambridge University Press, 1997), 2.
[682] Ibid.
[683] Ibid., 15.

science and its history in the following way. He began by describing a small book in his library. It contained "tables and figures and formulas."[684] He continued:

> The book contains logarithms and square roots, tables about the electrical resistance of wires of various metals and tables about the tensile strength of the principal kinds of wood. It contains equations that express the orbit of a planet and it contains a formula that permits one to prophesy how far one could see from a certain elevation. And another table can be used to predict whether meat could be cooked in an open pot in that altitude.[685]

He concluded: "And that, gentlemen, is science." It is not only "science" because it contains a list of facts and figures, but also because logical inference can be made from the collection of data. The data demonstrates that "the world is an orderly world, in spite of all its bewildering complexity."[686] It also showed why science developed so slowly, according to Ley. He then presented the perspective of other historians: "in former times, 'pure science' simply did not exist," because "what we now call the beginnings of science was in the hands of artisans and was, therefore, applied science."[687] In a long passage, he summarized the conclusions of existing historiography:

> …no research of any kind was undertaken unless a new problem presented itself. And as soon as a satisfactory answer to the problem was found research ceased. There was no struggle for the 'best' answer, because the conception that problems must necessarily have an optimal solution did not exist. Hardly anybody bothered about the theoretical reasons for the results obtained—certainly not artisans that obtained them. And the philosophers that occasionally did wonder about a theory made their 'theory' or 'system' before looking at the facts. If those facts did not quite agree with the system, they were either made to agree or ignored with dignity.[688]

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[684] Willy Ley, "The Search for Zero, part 1" *Astounding Science-Fiction*, October 1940, 122.
[685] Ibid.
[686] Ibid.
[687] Ibid.,123.
[688] Ibid.

Thus, historians concluded, science did not emerge until "naturally curious" individuals looked for the most perfect solutions "after realizing that the facts had to come first and the 'system' had to be molded to the facts."[689] Ley continued:

> This explanation, adorned and embroidered with gems of erudition scintillating in the light of after-knowledge, was—and is—also accepted by most scientists who usually add that political factors have to be blamed to a large extent for the tardiness of development. In saying this they think of religious dogmas, wars, revolutions, the smallness of countries and general political unrest. The historians again are ready to agree with the scientists about this addition—and only rarely somebody wonders why science progressed so nicely during the last two and a half centuries that, after all, had their full share of wars, revolutions, conquests, persecutions and general unrest.[690]

Ley concluded, "There has to be another answer. It seems that there is."[691]

What follows are 26 pages of rumination on the engine that drives scientific progress forward. It began in the realm of astronomy, which "forced its discipline to realize something of utmost importance."[692] Because astronomical events happened with precision and regularity, astronomers "learned to think in conceptions of precision, regularity, periodicity and invariability—all of which has the tendency to converge upon predictability."[693] The movements of the heavens obeyed "rigid rules," confirmed by dedicated observation.[694]

Upon the discovery of an orderly universe, "astronomy became the first science."[695] Yet it remained the only "real" science for centuries, "because people had not then realized that other things and events also obey rigid rules."[696] To sum, "people

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[689] Ibid.
[690] Ibid.
[691] Ibid.
[692] Ibid., 124.
[693] Ibid.
[694] Ibid.
[695] Ibid.
[696] Ibid.

lacked the conception of orderliness."[697] This was a key point for Ley that would emerge in many of his histories of science. The history of science was not simply a linear account of a gradual accumulation of facts, observations, or discoveries. It was also not a simple account of great discoveries or founding fathers. Instead, the history of science documented conceptual shifts, caused by the accumulation of facts and observations, which did not match a philosophical system. Nature forced humanity to see differently. Most importantly, people had to learn to distinguish between "man made and man found laws."[698] They had to show reverence to laws higher than themselves. In classical times, this task was incredibly difficult:

> There was no conception of law and order in Nature. That most important conception—that nothing happened haphazardly—was lacking. And for this reason—or lack of reason—facts were just facts, unrelated to each other. Not only that the facts were unrelated due to the lack of theories; nobody even thought that they might be related to theories.[699]

The real challenge in the ascent of man was a conceptual shift to see the world in a way that Nature demanded. For example, the "dim conception" of temperature had to be replaced by the idea of a boiling point. That new and revolutionary conception is the beginning of every science. "In short," Ley concludes, "you cannot arrive at anything so long as you believe things happen in a senseless manner, without rhyme or reason."[700] The first step of any scientific endeavor began with a "basic conception of order."[701] This "search for zero" was the search for a set of universal rules, "the rigidity of sequence," and the "starting point."[702] A science "that cannot count is not a science but

[697] Ibid.
[698] Ibid., 125.
[699] Ibid.
[700] Ibid.
[701] Ibid.
[702] Ibid., 126.

merely a collection of facts."[703] It must evolve from lists and enter the realm of classification, in which orderliness is exposed, allowing inference to be made. Otherwise, it is lost in a "blind alley… surrounded by hostile philosophers."[704]

It was not an easy maturation, and it could involve pitfalls. Astrology, for example, involved "a very interesting attempt to project the orderliness of the heavens onto the Earth."[705] Unfortunately, astrology "went haywire and did so with dire consequences to astronomy."[706] It "degenerated" back into the realm of philosophy.[707] Astronomers had to "struggle hard" to correct its course.[708] For these bold scientists, such as the brave Galileo, the Church was not the enemy. Astrologers and philosophers were their real opponents, with the Church trying to act as a "policeman" when "too many people are shouting too loudly."[709] Against a stubborn "mental attitude" of philosophers, the great men of science boldly offered the "destruction of mental security and the terrible realization that the road to knowledge was truly endless."[710] To the chagrin of philosophers, the astronomers "had practically been forced to talk facts while others talked ideas..."[711]

For chemistry, this struggle was harder. It had to "travel first all the way along the wearisome and disappointing road of alchemy… [which] began as fake and ended as one."[712] While some alchemists wanted to solve the "mysteries of Nature," the

[703] Ibid., 127.
[704] Ibid., 128.
[705] Ibid.
[706] Ibid.
[707] Ibid.
[708] Ibid.
[709] Ibid.
[710] Ibid., 129-130.
[711] Ibid., 130.
[712] Ibid., 134.

endeavor "was plain counterfeiting, without the slightest shadow of self-deception."[713] In Ley's perspective, their chief sin involved secret facts communicated in secret language. Nothing served to better hinder scientific progress than a lack of openness and cooperation. Chemistry had the longest road to travel:

> At the time when most of the other sciences found their 'fathers' and had at least accumulated long lists of facts, chemistry had still not even started. Its 'lists' were unintelligible, its classification was worse than useless. The chemical units of 'counting' were either unknown or unrecognized. Even a complete lack of knowledge would have been advantageous, for what was regarded as knowledge was ballast in reality—ballast that had to be discarded as quickly and as completely as possible.[714]

For other sciences, this battle for scientific progress happened sooner. Yet, the struggles were not easy. Overall, they involved wars against human prejudices, as well as "the looseness of terms and the cumbersome and intentionally mystifying language."[715] Scientists also had to struggle against the "complications of Nature."[716] "Nature," Ley wrote, "seldom displays one law at a time."[717] The scientist had to untangle those laws, discover relationships, and "find a way to get order out of chaos!"[718] Apparent disorder had to be dismissed. A science had to "thread its way out of that jungle... step by step."[719] It was the role of the scientist to make sense of the chaos by dismissing with delusions. They had to "doubt everything," while attempting make the ecological connections.[720] They also had to embrace holism.

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[713] Ibid.
[714] Ibid., 135.
[715] Willy Ley, "The Search for Zero, part 2," *Astounding Science-Fiction*, November 1940, 96.
[716] Ley, "The Search for Zero, part 1," 131.
[717] Ibid., 132.
[718] Ley. "The Search for Zero, part 2," 96.
[719] Ibid., 99.
[720] Ibid., 101.

Overall, science was a revolutionary and anti-authoritarian process, in which "many of the spiritual fathers of the revolution went rigorously on strike," refusing to show reverence for the great masters or the dominant conceptions of the philosophers.[721] While some of their older teachers would "have nothing to do with those newfangled ideas," the bold thinkers took science forward.[722] They had discovered zero. This was not the end of scientific revolutions. There would be new beginnings, perhaps as revolutionary as those of its past. "There never is such a thing as an end" to the engine that drives scientific progress. So long as the freedom of inquiry flourished and authoritarian dogma receded, the scientist could find the correct stepping-stones. He could destroy a rotten and false system of beliefs. He could build a new system on the garbage heaps of the past.

The World of Tomorrow-land

Ley would see many visions of the future come to life at the 1939 World's Fair in New York City. This massive exhibition of science, technology, and the world of tomorrow impressed Ley greatly. He reported on the anticipation regarding the spectacle in the British publication *Life and Letters*.[723] He wrote, "Only four years ago the several square miles of area that constitute the World's Fair grounds looked anything but interesting."[724] "Flushing Meadows" was the garbage swamp of New York City. Marvelously, engineers had transformed the area into a site suitable for the display of future engineering marvels. Ley spoke optimistically about the a "World of To-

[721] Ibid., 104. In this quote, Ley is referring to the "chemical revolution."
[722] Ibid.
[723] Willy Ley, "The New York World's Fair, 1939," *Life and Letters* 21:20 (July, 1939): 50-59.
[724] Ibid., 50.

morrow," with its "future city, showing skyscraper-like administration buildings in the centre, surrounded by a park in which public buildings like museums, opera houses, theaters, libraries, and similar structures are situated."[725] Ley continued:

> The visitor will see this model city from a slowly moving 'magic carpet', meaning a movable gallery inside the sphere near its 'equator'. The size of the model structures and the height and speed of the 'magic carpet' are balanced in such a manner that the visitor will receive the impression of circling above a real city at an altitude of about seven thousand feet… It is not the Perisphere alone where the Future is envisioned with models, moving pictures, light and sound and colour. The Chrysler Building will show a rocket ship departing from Earth under a tropical sky…"[726]

Ley spoke fondly of the "automatic machinery" that represented the "the first stage of what may develop into a kind of robot civilization."[727] He also appreciated the showmanship of the fair's optical illusions, spectator rides, and the "coloured floodlights."[728] He expressed his hopes surrounding the "Westinghouse Time Capsule," filled with books, photographs, and microfilm. It also contained a letter addressed to "humanity of the year A.D 6939."[729] Ley wondered about the reaction of human beings in 5000 years: "And it is quite possible that they may be impressed by a message from what they may consider a barbarian age that tells them about our daily life and about an exposition five thousand years ago that did not only display everything mankind had then achieved, but that also tried to gather the forces necessary for the "Building of the World of To-morrow."[730]

It is easy to imagine Ley touring the World's Fair with a sense of awe and wonder. As James Mauro explained, the World's Fair "boldly, bravely presented a

[725] Ibid., 51-52.
[726] Ibid., 52.
[727] Ibid.
[728] Ibid.
[729] Ibid., 56.
[730] Ibid., 59.

mind-boggling vision of the Future (usually with a capital 'F')." [731] Exhibits like "Futurama" and "Democracity" offered visitors the opportunities to tour the cities of the future from virtual heights, as they looked down upon models of the earth from balconies. Futurama was particularly popular, because it was free. The exhibit's ambitious design "not only made *seeing* the future a grand spectacle, but the *process* by which they were allowed to view it was as futuristic as the model itself."[732] Other scholars rightly point to symbolic power of the exhibits that promoted American modernism. These were the sites of "the ultimate expression of new corporate modernity for mass consumption—the Modern made simple, marvelous, and total."[733] Scholar Robert Bennett described the general scene: "Everywhere fairgoers went, they encountered diverse demonstrations of the fair's quasi-religious faith in modernist architecture, techno-rational urban planning, and progressive highway engineering."[734]

These sites offered an experience of enchantment, wonder, awe, and appreciation of the technological sublime. Many of those experiences happened through "virtual worlds" that served as the playgrounds of an engineer's imagination. David Nye's *American Technological Sublime* (1994) explained: "World's fairs exploited every form of man-made sublime… the goal was to awe the visitor."[735] Nye also noted the centrality of technologies of flight and the massive reshaping of landscapes of the future. Not only did flight represent "the acme of human achievements," but it also

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[731] James Mauro, *Twilight at the World of Tomorrow: Genius, Madness, Murder and the 1939 World's Fair on the Brink of War* (New York: Ballantine Books, 2010), xx.
[732] Ibid., 176.
[733] Terry Smith, *Making the Modern: Industry, Art, and Design in America* (Chicago: University of Chicago Press, 1993), 407.
[734] Robert Bennett, "Pop Goes the Future: Cultural Representations of the 1939-1940 New York World's Fair," in *Designing Tomorrow: America's World's Fairs of the 1930s*, eds. Robert W. Rydell and Laura Burd Schiavo (New Haven and London: Yale University Press, 2010).
[735] David E. Nye, *American Technological Sublime* (Cambridge: MIT Press, 1994), 199.

represented a shared and collective experience of fairgoers, who peered down from the heavens to view the world of tomorrow.[736] It was an experience of "transcendence," in which "powerful exhibits would lift the visitor out of the daily routine and hopelessness of the Great Depression."[737] Nye also argued, "These suspensions of ordinary spatial and temporal limits provided the sense of an olympian perspective."[738] Visitors, in turn, experienced "a simulated dream world in which everything seemed possible."[739] One particular exhibit culminated in a passenger rocket of the future: "Skilled stagecraft made this climax seem almost real, and the increasing tempo of this multi-media show… suggested uninterrupted acceleration through the ages."[740] The progress of mankind could be judged by speed. Despite so many elements of modernist design, the fair produced "a quasi-religious experience of escape into an ideal future equally accessible to all."[741]

Ley probably went directly to the "Science and Education" building, where he witnessed, in the language of a visitor's guide, "science… as a social force; as the new dynamic force which has chiefly created the modern world in which we live."[742] He must have supported the "over-all message" of the Education Exhibit: "…education in a democracy must be available to all men. It must train the whole man."[743] The tour guide emphasized the relationship between scientific education and democracy: Education "trains a man to be a better individual and a better member of society—to be a citizen

[736] Ibid., 201.
[737] Ibid., 206.
[738] Ibid., 213.
[739] Ibid., 216.
[740] Ibid., 217.
[741] Ibid., 223.
[742] *Official Guide Book of the New York World's Fair 1939* (New York: Exposition Publications, Inc, 1940), 197.
[743] Ibid.

rather than a subject, for subjects merely obey while citizens understand their world and take responsibility for it.[744] The tour book also commented on the timely need for a fair that united the energies of competing nations to cooperate in building the future. It then quoted a dedication speech that asked: "How can mankind work and live in peace and harmony? How can life be made more secure, more comfortable, more significant for the average man and woman?" It answered, "This Fair, *your* Fair, is determined to exert a social force and to launch a needed message."

These passages reflect the tensions of 1939. As scholars have noted, the unbridled optimism about the future coexisted with a fearful awareness of the rising tide of war. Mauro noted the overall irony of a world of tomorrow built upon the trash heaps of today: "That it was constructed on a notorious garbage heap stood as a prime example of unintended irony and unbridled optimism for the future, despite the looming certainty of war."[745] 13,000 people per day toured Futurama. Many of them stayed close to a radio. "Democracity" was the engineers' dream. In Europe, that dream was fading.

The Fog of the Present

By 1940, Ley increasingly viewed Nazi Germany and the Soviet Union as two variants of totalitarianism. These perceptions can be inferred from a science fiction story called "Fog," which Ley wrote for Campbell's *Astounding Science Fiction*. Because the story contained so many autobiographical hints, it is useful to describe it great detail. On a superficial level, the context of the story is quite different from that of Berlin in 1933 or 1934. The tale depicts a failed communist revolution in New York

[744] Ibid.
[745] Mauro, *Twilight at the World of Tomorrow*, xxiii.

City in the late 1940s. Nevertheless, it can be read in a way that reveals Ley's perceptions of both Nazism and communism.

In fact, editor John Campbell announced: "As a good many readers already realize, 'Robert Willey' is… Willy Ley."[746] He continued: "Astounding does not, ordinarily, publish author biographies; it is comparatively seldom that an author's background has much meaning in relation to his science fiction work." "Fog" was a notable exception, because it showcased the "very real and interesting relationship" between Ley's past experiences under a totalitarian regime and his science fiction nightmare of a communist revolution in New York City. Campbell added, "He knows from first-hand experience the churning uncertainty of revolution's fog… The result is, I think, a fascinating and paradoxical story—a clear picture of what revolution means to the innocent bystander…" Based on Ley's experience in Berlin, the tale depicts "what a revolution in a major nation is really like," along with its "maddening uncertainty."[747]

The story begins with a long quotation from a historian, who narrates the events of the Second World War. In this synopsis, the United States remained neutral, while the rest of world engaged in battles that spanned the globe, even into the countries of South America, where Brazil struggled to defeat a "Fifth Column." Hostilities then ceased, "due to complete exhaustion of all belligerent powers and for many years without some official restoration of peace."[748] The global situation led to "the complete disappearance of all world markets for any kind of goods" and a "severe economic

[746] "The Editor," "Fog," *Astounding Science Fiction*, December 1940, 6.
[747] Robert Willey, "Fog," 80.
[748] Ibid., 81. The remaining quotes in this paragraph are on this page. Other paragraphs follow a similar consolidation of footnotes.

depression in the United States." "A few months after the depression reached its lowest ebb," the historian explained, "certain elements succeeded…"

After this historical narrative abruptly ends, readers are introduced to the character of "the manager," as he concludes a disturbing phone call with "Central Office." While his office is abuzz with chatter and gossip about what the phone call could mean, the manager goes to lunch to ponder the situation. Sitting alone at a restaurant, he overhears a heated debate, in which a New Yorker says, "I have the right of free speech."[749] A communist responds, "That's one of those contemptible bourgeois prejudices you cannot forget." He adds, "Free speech in political questions should be reserved for those with political schooling." The communist then argues that an untrained American has no right to debate with the architect of a new and ultra-modernist building called "Clemens Tower," just as a patient has inadequate training to question his doctor. The reaction of the manager follows:

> The manager hurried his rice pudding and coffee. He wondered---as he had done occasionally in business meetings---why Nature had not provided some mechanism to close one's ears as one could close one's eyes. He paid and left, just when Clemens Tower was under discussion again. The manager also belonged to those without political schooling, else he would have recognized Karl Marx's recurrent "ten yards of cloth." As it was he wished that an earthquake would ruin that building beyond repair, he did not like its curving lines and turretlike corners anyway. And that man would have to find something else for comparison.[750]

The manager then returns to his office, where a colleague is waiting to discuss business. Yet, before turning to important business matters, they briefly discuss a young "office boy" who takes it upon himself to distribute copies of "The Worker." "He is good boy," the manager remarks, "but sometimes it looks hopeless." A character adds:

[749] Ibid., 83.
[750] Ibid.

> "Every kind of advice is considered old-fashioned and treated accordingly. I tell him that a man must work and plan ahead. He says that is a thing of a dim capitalist past that did not last long as geologic periods go. A natural man conforms politically to Nature, he says---don't ask me what that means---and the only worry one can have is to show revolutionary discipline, if, as, and when transition periods come along. I wish times would improve quickly; steady jobs, with decent salaries, are to radical germs of politics what quinine is to malaria germs."[751]

The two colleagues finally turn to business matters and various strategies for waiting out the economic depression.

When his workday ends, the manager walks home, thinking casually about the day's events, as well as his wife and his sister, who was expecting a baby. "Nature," he muses, "rarely suffered from depression, didn't show it at least, and always found a balance of some kind."[752] The streets, however, showed signs of disturbance and imbalance. Despite the absence of strikes or protests, the police acted nervously and on-edge, "standing there in a fairly silent and entirely normal street, listening---for what?"[753] One policeman griped his holster when the manager approached to ask for directions. Clearly, something was happening. The manager arrived at home and eased his mind by listening to his favorite radio program, an hour of soothing music uninterrupted by talk.

The next morning, the manager grew even more confused. Both his doorman and his favorite newsstand vendor were inexplicably absent. The radio news seemed to be entirely obsessed with an unimportant and minor building fire. Most strangely, the gates to subway entrances were closed, and there were few cars on the street. After finally obtaining a taxi ride to his office district, the manager then discovered that no traffic was allowed to pass into the area. He had to convince a skeptical policeman that

[751] Ibid., 84.
[752] Ibid., 85.
[753] Ibid., 86.

he was a legitimate employee of a firm at a specific and verifiable address. "What *is* going on here?" the manager asked. The policeman responded, "Sorry. Just orders. I am not supposed to hand out information. Besides I haven't any. Please move along."[754] The manager tried to guess which building the police were protecting. Apart from his office building, key sites included the Radio Corporation, the *Daily Post*, the Union Building, and the post office. He encountered a second police checkpoint, where he was required to show identification and proof of employment.

Finally, the manager arrived at the office, where he found many of his employees gossiping nervously about the events. After overseeing that his secretaries write letters of identification for all employees, he soon discovers that all long-distant calls have been suspended, while the radios went silent. Someone, possibly the police, had constructed a "Jenkins Radio Dome," which was "propaganda antidote extraordinary."[755] Having been invented during the Second World War, it served as an "electric field inside of which all wave lengths beyond the red end of the spectrum ceased to operate."

Suddenly came the crackling of gunfire and the explosions of grenades and artillery. Somewhere, on the city streets five stories below, violent street battles erupted. Then, just as quickly as it began, the gunfire ended. All became quiet, as streams of employees exited the buildings to head home. The manager described the scene:

> Everybody was just hurrying home; not wasting a single breath on a useless word. Some were crying quietly, but they hastened on just the same… The manager had been offered rides from various men from his building but had refused. It was an hour's walk, but he wanted to be alone. Everybody seemed to feel that way. The only remark he heard on the way was a young man saying

[754] Ibid., 88.
[755] Ibid., 92.

> rather cheerfully: "It ain't going to rain!" No, it wasn't; it never could rain in the area of a Jenkins Radio Dome.[756]

When he safely arrived home, the manager took stock of the revolution. Phones and electric power were out. The emergency stocks of stores were soon depleted. Meanwhile, trucks with searchlights roamed the streets, determined to expose anything that seemed suspicious, while the radio dome cast a hue of reddish light throughout the city. Here and there, the manager could see a few prisoners being marched by the police. "To prison? Or to execution?" the manager asked. Then, after hours of sitting in the dark listening to random bursts of gunfire, the manager fell asleep.

He spent most of the next day trying to wait out the violence. But, being desperate for supplies and especially cigars, he braved the city streets in search of an open store. Although he could hear distant gunfire, his own street seemed quiet, until suddenly bullets "whined past" amidst shouts to get back indoors. The manager lunged into a doorway that gave way to Mr. Alexander Segal's cigar shop. Mr. Segal sat behind the counter and greeted the manager with "friendly and unsurprised eyes."[757] "Good Heaven," the manager exclaimed, "you could open your store at a time like this?" "Vy not?" responded Segal, "the revolutionaries will also smoke." The manager asked, "Are you not afraid of the shooting?" Segal replied: "I am, I am, but what good does it? A bullet goes *zimm* through a closed door like though an open door. If it hits, it's God's will. What can I do about the bullets? It shoots here, it shoots there." The manager found this advice comforting. In fact, it "restored the manager's mental equilibrium." He bought an extra supply of cigars and returned home. After a long and trying day, the

[756] Ibid., 94.
[757] Ibid., 95.

manager closed his eyes. Only occasionally was he disturbed by the sound of random gunfire. Otherwise, he slept soundly.

A strange sense of normalcy returned the next day. Phone and electric power resumed. Gunfire ceased. And Joe, the doorman, resumed his duties, albeit dressed in a new costume: "a red necktie and a red armlet." [758] After he looked at the streets with pride, he greeted the manager with a set of memorized slogans. "Good morning, citizen," he called out formally, adding, "The people have won and the Change is made. Now good times are here for everybody who works." "I hope you are right," the manager responds. The uniformed doorman explained: "Oh undoubtedly sir… citizen, I mean. Now the government is in the hands of trained masters, not elected amateurs. There will be a Victory Parade on Red Square, starting at eleven. It is advisable to be punctual… In capitalist times it was called Washington Square." When the manager asked the uniformed doorman where he had been during the past few days, the doorman explained that he was protecting the new "people's government" in Clemens Tower.

The manager discovered other new facts. *The Daily Post* had been renamed as the *Red Flag*, and its first issue contained almost no reliable information. He also discovered that attendance at Red Square was mandatory after a rather frightening encounter with a group of uniformed henchmen. While walking down the street, an armed soldier with a red armlet called out: "Today is a revolutionary holiday… Better go to Red Square. Reorganization begins tomorrow." The manager then offered the soldier a cigar. The following scene occurred:

> "What does the citizen want?" interrupted a voice. Another half-uniformed man had approached, silently, since he wore canvas shoes. He

[758] Ibid., 96.

> did not carry a rifle but an automatic pistol, and he wore a narrow yellow armlet underneath the white red one. Evidently a superior.
>
> "Said he wanted to watch the parade on Red Square if there is no work. That's what he said, Comrade Lieutenant."
>
> The lieutenant looked a bit more friendly for half a second.
>
> "Lemme see your hands, citizen."
>
> The manager thought that the man wanted to make certain he was unarmed.
>
> "Gloves off! Wears a ring. Bourgeois. May have to be liquidated later on. Move on."[759]

Disturbed by this encounter, the manager continued to explore, heading toward Red Square. En route, he saw one of thousands of posters that stated the official "Proclamation" for all workers, soldiers, and citizens. After declaring that United States will be incorporated into the USSR, it advised all workers to return to work. Failing to comply would be recognized as sabotage. All political parties, societies, and social groups were banned, except those official organs of the state apparatus. All weapons had to be turned in. All travel was forbidden. A strict nighttime curfew was also imposed with a punishment of death for violations. Perhaps most importantly to the framers of the decree, all members of the non-working "leisure class" were to remain at their homes to await a special "census."

For the next few weeks, the manager experienced the everyday realities of a totalitarian state. City services remained sporadic and unreliable. The flow of everyday goods came to a halt, as stores remained sold out of bourgeois items of convenience. Pure propaganda permanently replaced news and information. The only dependable aspects of the glorious revolution were the "unwavering Radio Dome" and constant renaming of sites. The manager still had a position with the firm, but he was now under the supervision of Sam Collins, the previous office boy who distributed *The Worker*.

[759] Ibid., 97.

Sam's new managerial role involved monitoring and censoring all incoming and outgoing mail, while making a daily speech aimed at boosting worker morale. The speeches got shorter and shorter. Other changes took place on a daily basis. The manager narrated, "People are arrested occasionally. Sometimes they come back and tell that it was all a mistake…. Or they don't come back. In the middle of the night you hear heavy boots on the staircase."[760] When contraband is dropped from windows and "shooting starts… everybody insists that nothing happened at all during the night."

When the manager grows accustomed to these new realities, the glorious revolution falls apart and the story ends. Although pockets of revolutionaries had set up some footholds in major American cities, the revolution simply could not spread. Propaganda, in the United States, did not work. There was little popular enthusiasm to sustain the people's government. The American people simply rejected the ideology, while the United States Army could not be convinced to side with revolutionary leaders. The Army soon retook the cities in one quick sweep.

Rational and anti-authoritarian attitudes prevailed. A totalitarian revolution failed in a country that thought rationally and scientifically.

The Lungfish and the Unicorn

One book that eventually reflected this period and Ley's perspective as a historian of science was published in 1941, titled *The Lungfish and the Unicorn: An Excursion into Romantic Zoology*. It contained expanded versions of many of his articles that appeared in earlier magazines. Ley claimed that the book also reflected

[760] Ibid., 102.

"thirteen years in collecting" materials on animals, myths, and legends.[761] It had nothing to do with rockets. Even though it was published during a time when Ley had entrenched himself as an expert on war weapons, the book clearly reflected his true "romance" with nature during the 1930s. It also reflected his anti-totalitarianism, as he used the history of science as a weapon in a cultural struggle.

Ley began by stating that the individual chapters "will… not concern themselves… with the main stream of zoological theory and research."[762] Instead, they "deal largely with the borderlines, with the vague boundaries of knowledge, with the twilight zones."[763] While much of the book takes pleasure in debunking certain mythological creatures, such as the Unicorn and the "giants" of ancient Greek literature, other chapters are more optimistic about the discovery of sea serpents and other "living fossils." Some of the most comical moments of the book describe the history of bewildered scientists staring at strange fossils or wondrous specimens. Ley charted discovery after discovery of creatures that were thought to be mythological or extinct.[764]

In the introduction, Ley outlined the history of zoology in a concise and entertaining way. The roots of zoological thinking began with tribal distinction between "good" and "bad" animals. Then came pure human curiosity, when travelers told stories of "new and strange beasts in the new lands."[765] Aristotle took "the next step in the beginning of zoological science" by cataloguing known facts and compiling lists, which

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[761] Ley, *The Lungfish and the Unicorn: An Excursion into Romantic Zoology* (New York: Modern Age, 1941).
[762] Ibid., 18.
[763] Ibid.
[764] Chapters are playfully titled "The Great Unknown of the Seas," "The Curious Case of the Giant Sloth," and "A Century of Platypus."
[765] Ibid., 4.

was "the first stage of scientific thinking."[766] However, "the first great landmark in this stage of the science" came much later, with Pliny the Elder's *Natural History*. Ley clearly appreciated Pliny's debunking of Greek myths and legends: "The Roman Pliny had been a cavalry colonel and had wielded his stylus accordingly; if he had one firm belief, for instance, it was that all Greeks were liars."[767] Pliny's debunking of myths and legends was a vital contribution to the science of zoology.

Unfortunately, zoology then suffered through a "long artic night from Rome to Renaissance."[768] Ley's interpretation of history is clear:

> The Roman Empire collapsed. 'Darkness fell,' as the historians like to say, and the most valiant efforts of the Byzantines on the one hand and of the Arabs on the other could hardly preserve the knowledge gained, much less increase it and improve it. It needed the coming of the Renaissance… to bring a continuation of the 'quest for new lands and strange beasts.' It needed the discovery of the Western Hemisphere and the opening of the Far East. It needed the unearthing of the Greek and Latin classics and their wider distribution through the newly invented printing press.[769]

The "darkness" was at last "dispersed" by the boldness of Conrad Gessner, whose *Historia Animalium* (1555) "remained *the* natural history of expert and layman alike for two full centuries." Although Ley questions Gessner's "scientific method," he celebrates his contributions, arguing, "This man, whose broad mind was a mirror of classic knowledge, also started a new era."[770] However, Gessner's contribution was still simply a "list."[771] Granted, the amount of knowledge had increased. But, "the next stage" did not occur until Linnaeus "finally undertook the task" to name all animals and plants, while defining their relationships to each other in terms of "families, sub-classes,

[766] Ibid., 5.
[767] Ibid., 6.
[768] Ibid., 5.
[769] Ibid.
[770] Ibid., 6.
[771] Ibid.

classes, and orders.[772] This eighteenth-century "achievement of simplification" helped to create "a unified system of knowledge."[773] Linnaeus attempted to "bring rigidity and order out of chaos, not to suggest evidence of fluidity and change."[774] This was a step in the right direction, but almost immediately he insisted that species remained unchanged since creation. Ley described his statements as "dogma… [that] blocked the road ahead for a number of years."[775] "Linnaeus," Ley lamented, "had slammed a door."[776]

Ley then traced a direct link between taxonomy and the origins of evolutionary biology:

> Then out of this achievement another thought—as we know now, the most important thought of all—began to grow and to take form. Linnaeus had talked of species and sub-species, of families, and sub-families. Was it possible, was it conceivable, that these "families" of the system were actual families? That the relationships… not only expressed anatomic similarities but also might express genetic relationships? That these animals had not been created according to slightly changed blueprints but that they had evolved from one prototype, one original blueprint? That… generally speaking, animals living now had evolved from others? [777]

All it took to move forward was a band of fearless evolutionists, who did not show deference to the scientific establishment or its cherished "fathers." While they lambasted Linnaeus, they overlooked how his theories actually contributed to their thinking. This is one of Ley's clearest expressions on the evolution of science: "Without his classification the evolutionists would not have had an orderly system from which to draw conclusions… After all, it is easier to step over the tabooed boundaries in a well-mapped territory than it is to find a path through a complete wilderness."[778]

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[772] Ibid., 6-7.
[773] Ibid., 8.
[774] Ibid.
[775] Ibid., 9.
[776] Ibid., 10.
[777] Ibid., 8.
[778] Ibid., 9.

Likewise, the later evolutionists lambasted Cuvier, yet failed to appreciate how Cuvier himself had "crossed another and very important boundary line," by questioning if the Earth may have had a very different past. In his "quest for new lands and strange beasts," Cuvier was "carried away by his own enthusiasm." Nevertheless, his system of closed-off periods of catastrophe and extinction led others to see the Earth's past differently. Ley added:

> Nonetheless we have Cuvier to thank for crossing the borderline between the animal world of today and that of the past, and for bringing to light the new worlds beyond it. It is not to his discredit that Cuvier himself did not dream how tenuous this boundary really is, that it is full of holes through which countless "living fossils" have slipped. It is merely amusing that Cuvier, the man who saw clearly that there was such a borderline and who boldly crossed it, did his very best to strengthen it, to plug up the numerous gaps, and to deny its flimsiness in general.[779]

The anomalies soon added up. Fortunately, it was not long before Charles Lyell "succeeded in… wrecking the whole theory beyond repair."[780] While being influenced by larger estimates of the age of the earth, as well as notions of extinction, he "quietly discarded the slightly hysterical outbursts from the Continent and replaced them with *time*."[781]

For Ley, these events showed a pattern in the history of science. On the one hand, science matured through anti-authoritarian explorers, who boldly questioned the wisdom and authority of experts. The enemies of progress resigned in close-minded deference to figures like Aristotle and Cuvier. On the other hand, there was clearly a relationship between these great men, whose own contributions to science helped

[779] Ibid., 11-12.
[780] Ibid., 15.
[781] Ibid.

humanity to ascend, step-by-step, towards a more perfect and true understanding of the world. "Under the scientific method Truth is an absolute thing," Ley later asserted.[782]

Experts always demarcate the boundaries of science, yet it took bold adventurers to cross the borderlines, ask new questions, and seek out the unknown. If done in a rational way, the borders of science expanded and conceptual revolutions ensued. If done in an irrational way, the adventurers were cast adrift in a sea of pseudoscience and cranks. It is also interesting that, while the book is recounting the history of zoology, it is constantly shifting between the disciplines of geology and paleontology, before "the theory of evolution heralded a new day for the science of zoology, a busy, fruitful day."[783] Those bold adventurers were always interdisciplinary explorers. It was impossible to solve a zoological mystery without solving a geological mystery, or vice-versa. Revolutionary scientists embraced holism.

The remainder of the book crossed other borderlines of zoology. A history of unicorn legends leads Ley to attribute the myth to the rhinoceros. Ley similarly debunks "giants" in Greek literature. Ley is far more forgiving when it comes to the history of mysterious sea serpents, as told in the accounts of observers. Unlike other legends, "the persistent story of sea serpents are mostly based on obviously sincere eye witnesses and not on the continuity of a tradition."[784] Ley presents both sides of the debate, while debunking a few hoaxes. Nevertheless, he defends the eyewitnesses. On a Loch Ness sighting, "it was in all probability a warm-blooded mammal that was encountered again

[782] Willy Ley, "Science and Truth," *Astounding Science-Fiction*, December 1949, 96.
[783] Ley, *Lungfish and the Unicorn* (1941), 17.
[784] Ibid., 70.

and again by ships of all descriptions, bringing with it the bad luck of life-long ridicule for the skipper who saw it and who truthfully reported what he saw."[785]

Part III of the book culminates in a discussion of "Witnesses of the Past," which tells story after story about the discovery and history of "living fossils." From the horseshoe crab to the lungfish, some of these strange creatures had survived even the harshest of geological catastrophes. Others recently became extinct. Nevertheless, there is a central thread to each chapter, which laces this part of the book with a sense of wonder and mystery. The thrilling mysteries of science exist both in far away places and all around us. For example, the horseshoe crab, one of the oldest of living fossils, "can be found within sight of Manhattan's skyscrapers."[786] Something entirely new, different, and equally old might wash ashore near the horseshoe crab.

Readers are left wondering: Who knows what might be lurking in the zoological shadows or the oceanic depths? What else is out there? What other types of dogma will be discredited? What conceptual revolutions will follow a new age of exploration?

The Days of Creation

Ley advanced this romance with nature further in his 1941 book, *The Days of Creation.*[787] Like *Lungfish,* it presented an entertaining and holistic "biography of our planet" that compared geological periods of the earth with the Book of Genesis. A superficial scan of the table of contents would indicate that Ley was attempting to reconcile science and religion with chapters called "Let There Be Light" and "The Glory of the Mammals." Overall, the book makes the case that "these two accounts…

[785] Ibid., 102.
[786] Ibid., 226.
[787] Willy Ley, *The Days of Creation* (New York: Modern Age, 1941).

are remarkably alike as far as the sequence of events is concerned."[788] Thus, the chapters discuss the first "day" of birth of the sun and earth, the second "day" of the evolution of oceanic life, the third "day" of "the conquest of the land" by vegetation, and so on.

It is a history of evolution that celebrates the similarities between modern science and ancient myths. Ley was not trying to use science to make the case for the divine truth of scripture. No theologian, he argued, can seriously take the "first pages of the Bible as literal truth, knowing that this section of the Old Testament was one of the last to acquire its final form."[789] He attributed the Book of Genesis to early Babylonian myths and legends. However, Ley went on to celebrate the remarkable fact that nineteenth-century science independently established a history of the planet that essentially matched the "days" of creation, if "days" are equated with very long geological periods.

Ley also entirely dismissed the supposed need to "reconcile" science and religion. While he wrote the book, he recalled, "Others to whom I talked about this book asked me whether it was intended to be a 'reconciliation' between the story of creation as set forth in the Bible and the theory of evolution as taught by science. I think such a question is just about sixty years too late."[790] He described his primary motivation for writing the book: "Not reasons of high philosophy nor attempts to reconcile ideas that need no reconciling, but the pure joy of comparing two stories, each of them fascinating in itself and doubly so when regarded together."[791] Like other

[788] Ibid., 4.
[789] Ibid.
[790] Ibid.
[791] Ibid., 8.

intellectuals and religious humanists, Ley saw little overt conflict between evolutionary and biblical accounts.[792]

Ley then tried to inflict his "pure joy" by speaking directly to his readers: "Come out into the night with me, away from your reading lamp, and let us look at the stars."[793] He continued:

> The night may be warm, but even then you will experience a slight shiver of… no, not of cold. It is something else, something for which I do not know a perfectly fitting word, neither in English nor in any other language. It is a sensation of infinity; a sensation which does not exist in daytime. A sensation which has moved philosophers and inspired poets and which has, at least once, set everyone thinking.[794]

Ley presented the history of astronomy as a history of that "sensation of infinity," as the realization of a plurality of worlds led to a realization of a plurality of galaxies. For Ley, it was a story of the evolution of man's consciousness. He cannot help but humbly admire such extreme vastness and the complexities of Nature. The discoverers of that vastness and complexity had become the first scientists of the world. Here, Ley's histories of scientists are greatly simplified for narrative purposes.[795] Ley then follows "stage" after "stage" of later astronomical revolutions. "Let There Be Light!" is simultaneously a history of the universe and a history of man's enlightenment. Yet, this history of astronomical science is not presented as a peaceful journey from one stage to another. It involved a battleground of competing theories, which "might be likened to a

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[792] See, for example, the works of John Dewey and John Herman Randall Jr. For a more in-depth study of the religious roots of "secular" humanism, see the forthcoming book by Stephen P. Weldon. Indeed, one of the most fascinating aspects of this scholarship explore elements of conflict between humanist philosophy and logical positivism. It is clearly time for scholars to continue to revise narratives surrounding the rise of value-neutrality.
[793] Ibid., 11.
[794] Ibid.
[795] See, for example, Ley's description of Copernicus on page 13.

succession of encounters between battleships of increasing modern design."[796] Ley elaborated:

> The proud ship constructed by Kant, Laplace and Helmholtz had the inherent weakness of too little armor on the compartment containing the distribution of angular momentum. The new Tidal Theory of Jeans and Jeffries fired a torpedo which hit just this weakly guarded compartment and sank the ship, only to suffer the same fate before the more powerful vessel constructed by Chamberlain and Moulton. But this, too, impressive as it was, had its weakness which lost it the battle against the super-vessel of the glancing blow theory… I am sorry to report that this latest and proudest ship was also sunk just last year."[797]

Like the history of astronomy, the histories of geology and other sciences involved the planting of "mines" and explosions that led to conceptual revolutions. The gradual discovery of the age of earth was just such a story, incredibly comparable to the discovery of the universe. The remainder of *Days of Creation* tells that story in a similar way, while constantly inviting to readers to imagine the alien landscapes of past geological periods. Readers are invited to marvel as the first plants and then animals adventured out of the ocean.[798] The later ascent of man is no less wondrous than the "triumph of the reptiles" that came before.[799] Ley quotes scripture: "And creation had culminated in Man, who had been admonished to be 'fruitful and multiply and replenish the earth and subdue it; and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth.'"[800] This conquest of the Earth was a history of science, its bold adventurers, and their fearlessness to cross barriers.

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[796] Ibid., 42.
[797] Ibid.
[798] Ibid., 79.
[799] Ibid., 141.
[800] Ibid., 235.

Man would continue to ascend and adapt. Readers are invited to be skeptical of doom-sayers who claim otherwise. As the history of science proves, "Man… is adapting himself rapidly and most efficiently with new inventions all the time, and he remains the same, too, ready for further adaptations."[801] This journey of exploration, self-discovery, and reverence for the complexities of Nature would continue unabated. Not only would man survive, but also he would adapt to both new discoveries and new landscapes. Science and technology would serve as the engines of human progress. Despite the reverence for the complexities or the "sense of infinity" that produced awe and wonder, new conquests of nature would attest to that continuity. Nature lay ready to be further tamed and exploited.

The Broader Agenda

Ley wrote these books for a broad audience. Rarely did he openly admit an agenda, beyond entertaining and educating intelligent laymen. Nevertheless, we can see that he popularized a very positive image of science, along with a celebration of the key figures who contributed to the 'ascent of man.' At the same time, he belonged to a larger camp of "scientific intellectuals" who shared a vision of science as a unified human endeavor that unmasked a single reality.[802] Like others, Ley shared the goal of bringing science to the people, in an effort to transform and enrich culture.[803] This camp included other émigrés, such as members of well-documented "Vienna circle." It also

[801] Ibid., 267.
[802] The next chapter will greatly expand on this camp of intellectuals during the Second World War. Much more will be said about the broader context.
[803] For an interesting discussion of American efforts, see David A. Hollinger, "The Unity of Knowledge and the Diversity of Knowers: Science as an Agent of Cultural Integration Between the Two World Wars," *Pacific Historical Review* 80 (May, 2011): 211-230. Quote comes from page 212.

included many indigenous efforts of intellectuals to act as "instruments in the creation in the United States of a more secular, science-based culture, society, and politics."[804] Historian David A. Hollinger described this moment when the ideals of émigrés and indigenous American intellectuals converged to form a common agenda:

> More Jewish, more leftist, more immigrant, and more secular than the bulk of scientists and philosophers, the intellectuals who invested the most spiritual capital in what was called "the scientific attitude" were strikingly representative of interwar American academia, including the scientific establishment. This "attitude" had the greatest appeal to intellectuals who, whatever their backgrounds, favored an American future that would be more Jewish, more leftist, more immigrant, and more secular than the American past.[805]

Ley would have scoffed at this description of his efforts to educate and entertain. Yet, he belonged to a generation of Europeans who had witnessed the spread of irrationalism, pseudoscience, and mysticism throughout Germany. They also witnessed the role of mass media in the spread of dangerous and hateful ideas. Now, after escaping that context, they witnessed other events, such as the public "hysteria" on Oct. 30th of 1938 during Orson Welles' famous radio adaptation of *War of the Worlds*. Although the actual extent of the panic can be debated, the newsprint coverage demonstrated (to many intellectuals) how an enormous deficit of scientific knowledge and critical reasoning accounted for mob behavior and irrational action.

Elitist perceptions of mob irrationalism circulated widely among intellectual émigrés. They sought allies within the American intellectual community who also promoted "the scientific attitude." Instead of encountering resistance, they found "a well-established tradition of science-centered, publicly engaged philosophy that took

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[804] Ibid.
[805] Ibid., 213. See also, David A. Hollinger, *Science, Jews, and Secular Culture: Studies in Mid-Twentieth Century American Intellectual History* (Princeton: Princeton University Press, 1996).

the unity of science for granted."[806] It included the efforts of men like John Dewey, who embarked on a quest "to make the world more scientific."[807]

Ley shared that goal. Yet, unlike some intellectuals, he did not campaign for a more scientific world in the pages of isolated scientific or academic journals. He did not retreat into a research lab or an ivory tower. He was not campaigning behind-the-scenes to bring the "scientific method" into use in the "social, political, and economic realms."[808] He did not lament the rise of mass media as key cause for cultural degeneration and the spread of "nonsense." He did not share the reactionary pessimism of many contemporary analysts of radio or later cultural critics.

Instead, he spoke directly to the public, attempting to promote a version of "scientific thinking" that was neither stripped of wonder nor confined to a journal, institution, establishment, or field of study. His version of scientific thinking was a very far cry from "disinterestedness," as promoted famously by Robert K. Merton. While the adventures of some academic intellectuals led to conferences or heated, philosophical exchanges in the pages of relatively obscure journals, Ley's navigated the publishing scene of cosmopolitan New York City. In the pages of science fiction pulps, general and natural history magazines, and books aimed at both a juvenile and adult reading public, Ley explored the history of science, while promoting his own versions of the ideas that circulated in discourse. In his own way, he celebrated the "epistemic unity of all mankind," as embodied by science.[809] He also celebrated the "wholeness" of science. Just as he adored the cosmopolitanism of New York City, he presented "universalist,

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[806] Ibid., 214.
[807] Ibid.
[808] Ibid., 216.
[809] David Hollinger, "Science as a Weapon in *Kulturkämfe* in the United States During and After World War II," *Isis* 86 (Sep., 1995): 440.

cosmopolitan constructions of the cultural meaning of science."[810] But, perhaps unlike that quote, Ley spoke in everyday language that non-specialists could understand. Most of all, Ley promoted a "code of the scientist" that fit well with the later views of social scientist Mark A. May.[811] Hollinger summarized:

> May… had his list of elements in the "morality of science," which he, more explicitly than Merton, advocated as the basis for a culture that should sweep the United States and the world, so that ordinary citizens would live by the code of the scientist: the code of honest, free inquiry, the code of critical, interactive, evidence-based, universalistic, antiauthoritarian, and hence "scientific" conduct.[812]

May wrote, "Let all mankind imitate the fellowship of science." Yet, to Ley and others' dismay, mankind did not imitate the fellowship of science. Instead, madness spread.

A Brief Moment in Time

Weeks before the bombing of Pearl Harbor, Ley visited Fritz Lang and Robert A. Heinlein in California. This month-long vacation involved a trip to "the forest of the giants" in northern California. It was one of Ley's most memorable romantic excursions, in which he became a witness to the ancient past. He remembered, "We stopped for the night in Visalia and all through the night there was a howling storm with sleet and rain. I should have expected that from latitude, altitude, and season. But reasoning needed some time to overcome an established mental picture; for hours I was experiencing a kind of prolonged wondering surprise."[813] When Ley and Heinlein spent

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[810] Ibid., 441.
[811] Mark A. May, "The Morale Code of the Scientist," in *The Scientific Spirit and Democratic Faith*, ed. Eduard C. Lindeman (New York: King's Crown Press, 1944), 40-46. See also Hollinger, "Science as a Weapon," 442.
[812] Hollinger, "Science as a Weapon," 442.
[813] Ley, *Dragons in Amber*, 185.

much of the next day touring the sequoias, Ley experienced an emotional appreciation of Nature:

> The next day, too, was a cold and unfriendly day with intermittent rain… It was a kind of weather and a kind of day that would have been abominable in either the city or the country and all the more so in other mountains. It was a kind of weather and a kind of day that one would have tried to forget as quickly as possible—if one had experienced it anywhere else. But in that forest of the red and green giants—in spite of my initial surprise—the cold rain enhanced the quality of timeless vitality that surrounds the sequoias.[814]

Unlike other trees, the sequoias did not "seem to cower under the clouds, waiting for them to disperse."[815] Instead, "They reached up and supported them."[816] Ley continued: "The gigantic columns of living wood, their green boughs partly obscured by the cloud veils, seemed to create a strangely roofed island. Not an island of mountain forest… but an island in time, an island in the time stream which flowed around them. And also an island of silence."[817] Ley displayed reverence for Nature, adding, "One does not speak loudly in the forest of the giants."[818] Overcome with the gift of a "special permit," Ley spent "a few hours in the past, in the forest in which much of later civilization originated and which became the unavoidable background of all folklore."[819]

After Ley returned to New York City, he had to face an immediate present. While "Nature rarely suffered from depression… and always found a balance of some kind," the opposite was true of human beings.[820] Instead upholding a scientific and moral code, the world went to war. It was time for Ley to enlist.

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[814] Ibid.
[815] Ibid.
[816] Ibid.
[817] ibid.
[818] Ibid.
[819] Ibid., 186.
[820] Ibid., 85.

Chapter 5: The PM Years and the Science Writers at War

In May of 1940, Willy Ley joined the staff of the political tabloid *PM*, a leftist and provocative "picture magazine."[821] The publication was the brainchild of editor and social activist Ralph Ingersoll, who believed that the power of advertisers corrupted the objectivity of the press. Instead of relying on the money of capitalistic power brokers, *PM* would rely on the pockets of readers, charging 5 cents for daily editions and 10 cents for special issues.[822] Accordingly, the tabloid claimed to present the unvarnished truth, unsullied by the advertisements of war profiteers or media conglomerates. It also claimed to represent the pure objectivity of serious journalism, combined with a rational evaluation of facts.

The tabloid often stated its manifesto:

> This Is *PM*… We are against people who push other people around, whether they flourish in this country or abroad… We do not believe all mankind's problems are now being solved successfully by any existing social order, certainly not our own, and we propose to crusade for those who seek constructively to improve the way men live together… We are Americans and we prefer democracy to any other principle of government.[823]

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[821] Despite its rich content and relevance for historians, many historians have overlooked *PM*. Useful starting points can be found in several theses that did not mature into publications. By far, the most useful history can be found in Steven Marc Luxenberg, "The Dawn and Twilight of *PM*: A History of the New York Daily Newspaper, 1940-1948," Thesis A.B. Honors, Harvard University, 1974; See also, Michael Joseph Minerva and Ralph M. Ingersoll, "'On the Journalistic Summit': An Analysis of Ralph Ingersoll's Great Experiment, the Newspaper *PM*," Thesis (BA, Lake Forest College, 1987); Robert M. Henry, "The Newspaper *PM* and the basis of its Communist Image," Thesis (M.S, University of Kansas, Journalism, 1968); Anya Schiffrin, "We are Against People Who Push Other People Around: A Study of the Newspaper *PM*," Thesis (B.A., Reed College, 1984). For a primary source that documents the tabloid and public reactions, see Mildred Mae Diefenderfer, "An Analysis of the New York Newspaper, 'PM'," Masters Thesis, (University of Wisconsin-Madison, 1951). An additional starting point can be found in the autobiographical writings of Ralph Ingersoll, as well as Roy Hoopes, *Ralph Ingersoll: A Biography* (New York: Atheneum, 1986).

[822] In reality, *PM* often relied heavily on Chicago millionaire and publisher Marshall Field III, particularly in times of debt. The newspaper's financial scheme of both relying on customers and printing lavish pictures was simply not sustainable.

[823] "This is PM." *PM*, July 4, 1941, "Opinion."

Despite its denial of party affiliation, the publication had a clear and consistent crusade during its early years. In fact, the editors of *PM* could easily fit with media historian James L. Baughman's camp of "voluntary propagandists."[824] Foremost, *PM* sought to expose the war crimes of Germany, while pleading for U.S. entry into the European theater of war. Given the crimes against humanity, neutrality was not an option. In a bold-typed "In Memorian," *PM* screamed, "35,953 Innocent Men, Women and Children Killed By Fascist Bombs… What Are We Going To Do About It?"[825] To shock readers, *PM* printed full-page pictures of dead women and children.[826] Thus, *PM* fulfilled all three journalistic traditions of advocacy, reportage, and exposé.[827]

Not only did *PM* denounce fascism abroad, but it also exposed fascist threats at home. Headlines advocated for immediate action against a rightwing "Fascist Front" in the United States. Favorite targets included Charles Lindbergh and Charles Couglin. Anyone who openly sympathized with the Nazis or voiced isolationist sentiment was branded as a domestic enemy who aided the foreign menace. From *PM*'s perspective, the sympathizers openly plotted a "Fascist Revolt," while they blanketed the country with propaganda though Hearst's monopoly of newspapers and magazines.[828] In the face of these threats, *PM* aimed to educate the American public, debunk propaganda, and generate support for intervention. These activities indicate that extending the

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[824] James L. Baughman, *The Republic of Mass Culture: Journalism, Filmmaking, and Broadcasting in America since 1941* (Baltimore: The John Hopkins University Press, 1992),
[825] Special Issue: "War is at our Doorstep – WHAT ARE WE GOING TO DO ABOUT IT?" *PM*, May 18, 1941, 5.
[826] For example, see "Foreign," *PM*, July 13, 1941, full page.
[827] For an interesting analysis of the tensions between these traditions, see Christopher B. Daly's *Covering America: A Narrative History of a Nation's Journalism* (Boston: University of Massachusetts Press, 2013).
[828] Alexander H. Uhl, "Lindberg Lays Foundation for Fascist Revolt" *PM*, October 5, 1941, 8. When the *Saturday Evening Post* published "The Case Against the Jew," by Milton Mayer, *PM* denounced it as slander and an "attack on national unity and confidence." See inside cover of *PM*, April 2, 1942.

timeframe back to 1940 complicates Baughman's perception of a united front in the press. *PM* continued to battle rightwing publications throughout the war.

Predictably, *PM* attracted a large cast of idealistic journalists, photographers, and illustrators. Notable individuals included outspoken journalists I. F. Stone and James Thurber, along with illustrator Theodor Geisel (better known as "Dr. Seus"). *PM* also supported a large cast of photographers, sports experts, and media critics, whose work filled the pages of weekend editions, when the tabloid took a break from scandals and political rants. Instead, its longer Sunday special issues printed more pleasant articles, as well as large photographs, including scantily clothed pin-up girls. Readers could also receive updates on *PM*'s baby, Lois, as she developed from infant to toddler.[829] Additional content included public interest stories and fashion advice.

Ley described his initial role at the tabloid as follows: "I represent science and aviation in the radio-advertising Presearch [sic] Department which is… really the Department of the Future. We are concerned with things to come."[830] Although he would later become *PM*'s "science editor," he joined the staff as a researcher. He informed Heinlein, "It is, believe me, woefully hard to convince newspaper people that they should open some space for science. At first, they said they would, last night they decided that they could not possibly do it… with a war and conventions going on and more war and a presidential campaign with broken traditions coming up – and I feel

[829] "Lois's Vocabulary Jumps From Three Words to 40," *PM*, July 27, 1941, 59.
[830] Willy Ley to Frederik Pohl, June 17, 1940, Frederik Pohl Papers, Syracuse University Library, Box 7, "Correspondence with Dr. Willy Ley."

somewhat hrt [sic]."[831] Ley had to focus on the technologies of war, in order to make science relevant to readers.

Ley spent a great deal of time at the offices of *PM*. "I am rarely at home these days," he wrote.[832] Ley later worked "the night force," from 3 pm to 11 pm.[833] Much of this work likely involved fact-checking and perhaps translation duties. While he campaigned behind the scenes for more scientific content, very few articles on science appearing prior to January 1942. For the editor, the war cause was simply too important to devote much daily space to non-essential content. Occasionally, *PM*'s weekend edition might accommodate Ley's interests. Otherwise, the tabloid had a solid formula of updating readers on the war front, while lambasting American publications that helped the enemy's morale.

Historians have wondered why Ley associated himself with a publication that employed communists while engaging in political slander, accusations of treason, and even a brief battle with the Army for drafting its editor (who claimed to be serving the cause more properly at home). It is tempting to view Ley's relationship with *PM* as one of convenience. Although his salary is unknown, it was his first steady employment in the United States. Being on *PM*'s staff may have allowed him to do much of the busy work for his books and articles. Additionally, it was very convenient for Ley to associate himself with one of the most anti-fascist newspapers when he was still an enemy alien, fearing the possibility of deportation or imprisonment. If Germany

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[831] Ley to Heinlein, July 18, 1940, Heinlein Archives, Box 305, "Correspondence, Pre-War, 305J." For a superb biography of Heinlein, see multiple volumes of William H. Patterson's *Robert A. Heinlein: In Dialogue with His Century* (New York: Tor Books, 2011).
[832] Ley to Pohl, September 21, 1940. FPP, Box 7, "Correspondence."
[833] Ley to Heinlein, February 3, 1941, HA, Box 305, "Correspondence, Pre-War, 305J," 1.

declared war on the United States, Ley might be detained or imprisoned, as his father had been during the Great War.

He did not sympathize with many of the staff's communists, as can be seen in his science fiction. It is tempting to imagine that Ley studied some of the staff as if they were bizarre human specimens. When Heinlein asked him about an article that reported on a talking dog, Ley responded: "It's not a hoax."[834] Ley then described the story's reporter: "He's a communist and consequently devoid of any kind of imagination as I found out in many conversations… If O'Connor says a dog talked in his presence that dog most decidedly did."[835]

While it would be easy to characterize Ley's role for *PM* as self-serving, convenient, and even apolitical, a closer look at his evolving relationship with the tabloid will reveal a more complex portrait of a science writer during the Second World War. If one label could describe Ley's public persona from late 1941 to early 1944, it would be that of a "war weapons expert." Generally speaking, Ley wrote far less about space travel and natural history. There are important exceptions to this trend.[836] For the most part, Ley became immersed in technical journals, military histories, and news of the war front, as he attempted to educate Americans, alleviate public anxieties, and

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[834] Ley to Heinlein, September 11, 1941, HA, Box 5, "Correspondence, Pre-War, 305-J."
[835] Ley to Heinlein, November 9, 1945, HA, Box 220-1, "Personal Correspondence, 1943-1971."
[836] As mentioned previously, Ley's *Lungfish* and *Days* were both published in 1941, although it should be noted that the majority of research and writing was done in the late 1930s. See also, Willy Ley, "The Vanishing Meteorites," *Super Science Stories*, November 1942, 119-123; "The Seven Follies of Science," *Amazing Stories*, January 1943, 228-237; "Tyrannosaurus was No Killer," *Astounding Science Fiction*, April 1943, 81-84; "Stepping Stone to the Stars," *Super Science Stories*, May 1943, 92-95; "Sea of Mystery," *Astounding Science Fiction*, June 1943. Ley also wrote "The End," his two-part history of the VfR in 1943. On natural history, see *Frontiers*: "The Barnacle Geese," October 1941, 20-23; "The Land that Never Was," April 1941, 99-102; "Pictorial Evidence," October 1942, 20-23; "Basins of Destiny," February 1943, 84-86; "The Story of the First Bird," June 1943, 157-159; "The Case of the Missing Fossil," February 1944, 66, 85-87; "Symmes' Hole: The Story of the Man Who Preached a World Within a World," October 1944, 3-4, 28-30; "Where Did We Get the Pig?" April 1945, 103-104, 119-120. For an interesting postwar article, see: "How Man Began to Understand Fossils," October 1945, 8-9, 30-32. Other venues included *Fauna* and *Natural History Magazine*, albeit far less frequently in 1942 and 1943.

debunk German propaganda. Although his down-to-earth explanations of war technologies rarely contained overt political statements, his science writing cannot be divorced from politics and anti-authoritarian beliefs, particularly when compared to a broader scene of New York-based science writers. His central message of "Keep Calm!" also related to his firm belief in the power of scientific thinking, especially during times of fear. Although a survey of his writings might give the impression that Ley was deeply fascinated by the technologies of war, it would probably be more accurate to say that he was deeply fascinated with the publishing world of New York City and the public's demand for reliable information on a daily basis. Ley embraced the role of the science writer as an interpreter of information that could, in the wrong hands, be used to produce hysterical responses. In essence, the science writer could enlist in the war effort by becoming a journalist who reported on wartime science and technology. It became a vital public service when the war became global and total.

The "Presearch" Phase

Throughout early 1941, Ley worked mostly as researcher, occasionally writing very short columns. Then, his direct writing for *PM* increased briefly on June 29, 1941, when the tabloid introduced Ley's "New Weapons Department." The editor invited readers to submit their ideas for future war weapons "designed to lick the Nazis."[837] Ley would judge the merits of their concepts and write a few very short paragraphs explaining why the idea would or would not work. Incidentally, the first installment criticized a reader's suggestion of "rocket cannons" as too expensive. "What could it do

[837] "New Weapons Department" *PM*, June 29, 1941, 38.

that existing weapons cannot?" Ley asked.[838] In nearly all of these columns, Ley gave a "thumbs down" to the ideas of readers, who seemed to not understand the mechanics of existing weapons.[839] This column was not popular, and it did not last very long.

What emerged from his behind-the-scenes "Presearch" on weapons can be read most directly in a book that Ley wrote in 1941: *Bombs and Bombing*. In calm and unimposing language, Ley explained the various types of bombs being used in the war. Overall, it was a fairly dry and educational book. Instead of encouraging a sense of wonder about nature or modern marvels, Ley moved from one discussion of weapons to the next, attempting to simply educate the reader about weapons of war. As a "brisk, popular survey" Ley explained the mechanics and mechanisms of bombs, the physics of explosions, and the effectiveness of various types of shelters.

Only one section of the book brought Ley's personality to the surface, when he attempted to debunk and dethrone the popular prophets of doom and their "'horror' novels" that created "general poison-gas hysteria."[840] Ley aimed his sights most directly at H. G. Wells, whose *Shape of Things to Come* contained "a skillful symposium on chemical horrors, surpassing the fancies of lesser writers…"[841] After quoting the book, Ley stated, "I hasten to assert and emphasize that *none of Mr. Wells's statements contains even a grain of truth*, save for the one which says lewisite was discovered by Professor Lewis of Chicago and that it was not used in the first World War."[842] He added: "But Wells's ridiculous nonsense reflects what many persons still believe about

[838] Ibid.
[839] See, for example, Willy Ley, "Bat Men for Parachute Invasion: Troops Sour Into Combat Units Before Landing," *PM*, July 20, 1941, 64.
[840] Willy Ley, *Bombs and Bombing* (New York: Modern Age, 1941), 51-53.
[841] Ibid., 55.
[842] Ibid., 56.

poison gas."[843] The remainder of this chapter reverts to a dispassionate tone, as Ley explained the facts, while discrediting the military effectiveness of chemical weapons.

The calm, objective, and scientific tone of the book caused one reviewer to call it "morbidly interesting and readable."[844] Despite the lack of any sense of moral outrage about destruction and the loss of human life, the book could be read as "reassuring and encouraging," because an air raid on New York City "could hardly be half as bad or as devastating as most people imagine."[845] Indeed, Ley's main message in the book was put in bold-faced print in the second edition. "KEEP CALM!" he yelled. For many reviewers, this message was "comforting."[846] For the "perhaps perturbed reader," the book provided "consolation in acquaintance with modern measures of defense, active and passive, against gas bombs."[847]

Not only would ground defenses be effective counter-measures to aerial bombardment, but also the ultimate effects of bombs and bombing were not completely devastating. A reviewer summarized: "The fact is… that the worst air attack imaginable could do only a certain amount of harm, unless it went totally unopposed…"[848] Another reviewer commended the book because it "offers succinct statement and explanation to dispel the vague terror which is founded on ignorance."[849] The book accomplished its primary aim: "Ley is definitely encouraging; but encouraging or not, the information he presents should be conducive to calmness and sound preparation of mind."[850] A different reviewer went further: "This valuable little work should… calm the fears of

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[843] Ibid.
[844] Ralph Thompson, "Books of the Times," *NYT*, Dec 30, 1941, 17.
[845] Ibid.
[846] Calvin Goddard, "Review," *Military Affairs* 6 (Spring, 1942): 50-51.
[847] Ibid., 50.
[848] Thompson, "Books of the Times," 17.
[849] K.W., "Fire and Poison From the Air," *NYT*, Jan 18, 1942, BR8.
[850] Ibid.

the hysterically apprehensive, at the same time making it plain that certain precautions can and must be taken if casualties from the skyborne missiles are to be held at a minimum."[851] There was no reason for panic.

A Russian Beauty

Throughout the month of October, Ley was a bachelor on vacation.[852] After a brief stop through Chicago, he had flown to California to visit Heinlein, who may have introduced him to novelist named Virginia Purdue.[853] This was also the moment that Ley had a quasi-religious experience in the "forest of the giants." Ley arrived back in New York on November the 3rd. At some point during this period, he met Olga Feldmann, who joined the staff of *PM* as a fitness columnist and model while Ley was vacationing. While her pictorials offered useful advice, the photographs of her exercise poses could be provocative for 1941. Ley informed Heinlein: "I found her in our office when I came back from Hollywood… She is Russian, born some 29 years ago in what was then still St. Petersburg."[854] Ley further described Olga:

> She is in this country since 1920, citizen "by derivation" (since her parents took out papers while she was still a minor), is utterly reliable, lacks the proverbial Russian temper completely, flawlessly good-looking (I avoid stronger terms which may seem prejudiced), speaks English, French, German, and Russian flawlessly, modern Greek almost fluently and has an IQ in the neighborhood of 175. Are these reasons enough? As for me the most important one is that she loves me. And that she is old, experienced and intelligent enough to know what that word means when she uses it.[855]

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[851] Goddard, "Review," 51.
[852] Ley visited Fritz Lang after a stop in Chicago to pay visits to a museum and the editorial office of *Amazing Stories*. Ley to Heinlein, September 6, 1941, HA, Box 305, "Correspondence, Pre-War, 305J," 1.
[853] Heinlein to Ley, September 11, 1941, HA, Box 305, "Correspondence, Pre-War, 305J."
[854] Ley to Heinlein, December 23, 1941, HA, Box 305, "Correspondence, Pre-War, 305J."
[855] Ibid.

They became engaged on Dec. 11th, the day that Hitler declared war on the United States. They married two weeks later, on Christmas Eve. Olga moved into Ley's small New York apartment, while both continued to work for *PM*.

A Science Writer Enlists

Although Ley was still an enemy alien, he was now married to an American citizen. Yet, he still feared deportation or internment. On January 14th, Roosevelt issued Presidential Proclamation 2537, which required all enemy aliens to report changes of address, employment, or names to the FBI. Soon, Executive Order 9066 authorized the creation of "exclusion zones," which soon led to the internment of both enemy aliens and American citizens of Japanese ancestry. There was much talk in the streets and press about a possible German internment. *New York Times* headlines indicated that the FBI was beginning to question and detain Germans and other European enemy aliens.[856]

At precisely this time, Ley began to write fairly regular and much longer articles for *PM*. Whether this increase of articles was due to his initiative or the goals of the editor are unclear. It was probably a combination of the editor's desire to educate readers about the realities of warfare and Ley's attempts to publicly associate himself with the most pro-war and anti-fascist newspaper in New York City. It is also noteworthy that Ley's efforts to educate the American public about the technicalities and dangers of war weapons came at precisely the point when other publications, particularly *Astronautics*, suspended their presses. President H. Franklin Pierce told members of the American Rocket Society: "Because of the military potentialities of

[856] "14 Enemy Aliens Questioned by FBI: 9 Germans and 5 Italians Are Asked about Contraband in Their Possession, All Facing Internment," *NYT*, February 22, 1942, 22.

rocket power it is deemed essential that the dissemination of further information on the subject be curtailed."[857] He then urged his fellow enthusiasts to "use discretion in talking of past experiments, or in giving any information relative to rocketry which might be of aid to the enemy."[858] While the ARS became silent, Ley offered readers a sober examination of the potential of war rockets, as well as much information on the history of their designs, fuels, and uses. Most likely, he viewed the ARS's silence as silly, considering that most of the material was readily available in public libraries and archives.

In the pages of the *PM*, Ley also reiterated the themes of *Bombs and Bombing*.[859] His "War Weapons" articles explained the technologies of war and the tactics of enemies. These articles doubted the effectiveness of most types of gas bombs as well as biological warfare: "Could not the whole war be won by decimating (if not exterminating) the population of all the big cities by means of germs? The answer is NO."[860] On the effects of gas bombs, in particular, Ley was waging a public campaign to dispel nonsense that had been published in many books. Ley explained, "When the present war started, most people expected that things they had read in books and magazines for many years now would be terrible truth. They believed in all seriousness that the new war would be a 'poison gas war,' a war not only without victors, but a war

[857] G. Edward Pendray, "To the Members of the American Rocket Society," January 15th, 1942, PP, Box 11, "American Rocket Society, 1941 General," 1.
[858] Ibid.
[859] Ley's *PM* articles are too numerous to list. For a representative sampling, see PM's month of January, 1942, which included: Willy Ley, "The Tools of War: Calibers," January 5, 1942, 20; "War Weapons: Shells and Shooting," January 7, 1942, 18; "War Weapons: H.-E. Stands for Controlled Power," January 8, 1942, 20; "War Weapons: Fuses," January 9, 1942, 20; "Pineapple and the Potato Masher," January 12, 1942, 20; "War Weapons: Trench Mortars," January 13, 1942, 20; "To Win the War, We Need South American Products," January 14, 1942, 14-15; "War Weapons: The Livens Projector," January 14, 1942, 20; "War Weapons: Rockets," January 16, 1942, 20; "War Weapons: Ground Mines," January 15, 1942, 20; "War Weapons: Mlle. La Soixante-Zuinze is Now an American," January 19, 1942, 21; "War Weapons: The Barrel of the 'Paris Gun'," January 27, 1942, 10;
[860] Willy Ley, "War Weaons: The Truth About Germ Warfare," *PM*, March 6, 1942, 9.

without survivors."[861] Public misinformation was the result of a "systematic campaign carried out by countless would-be prophets of the 20s."[862] Chief among the offenders was H.G. Wells whose *The Shape of Things to Come* displayed a dishonest relationship with facts: "Truth was a minor consideration in this campaign; sensationalism was what counted."[863] Instead of offering fantastic nightmares of future wars to come, Ley countered with sobering facts and calming predictions.

In the midst of Ley's attempts to debunk the earlier works, a book became a bestseller: Major Alexander P. de Seversky's *Victory Through Air Power*.[864] The title indicates the central theme of the book. When Ley read this book, he immediately sat down to write his own book-length response, published in 1942 as *Shells and Shooting*. In the text's introduction, he explained his motivation: "Recently the writer of a highly overpromoted and forcefully circulated book asserted with great vehemence that the age of artillery is over now, that airpower—the bombing plane—has taken over and that heavy batteries, fortified positions, and anything afloat (especially battleships) are outclassed, obsolete, and a waste of money." Ley responded: "I cannot subscribe to such a thesis."[865] The remainder of *Shells and Shooting* presented a detailed survey of ground weapons that could counter aerial bombardment. On the subject of war rockets, Ley concluded: "It is not likely that rocket artillery will be revived during the present war."[866]

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[861] Ley, "War Weapons: Poison From the Air," *PM*, May 29, 1942, 10.
[862] Ibid.
[863] Ibid.
[864] Alexander P. de Seversky, *Victory Through Air Power* (New York: Simon and Schuster, 1942).
[865] Willy Ley, *Shells and Shooting* (New York: Modern Age, 1942), 11-12.
[866] Ibid. 223.

A much more forceful attack on Seversky's thesis was presented in the pages of *PM* on December 9th, 1942. The four-page article, "Debunking Seversky's 'Victory Through Air Power'," stated directly: "It is important that people get the facts straight."[867] Ley classified the book with "50 such books" produced during the interwar years. "They all made exiting, if gruesome, reading," he wrote, "but as for actual value—military or prophetic—none was worth the paper it was printed on."[868] He also accused publisher Simon and Schuster of a dishonest letter-writing scheme, as well as an "unbelievable advertising campaign."[869] He argued: "The book saw a promotion as no other book in all history, with the possible exception of *Mein Kampf*. It was crammed down the throat of John Q. Public…"[870] Simon and Schuster profited well from a fear-mongering prophet of doom and his "old horror soup."[871] Ley then compared Seversky's book to the propaganda of Goebbels, while accusing Seversky of undermining the war effort: "It is clearly evident that Seversky has little if anything to contribute to the war effort. It is just as evident that his scathing… criticism of our High Command has done great harm to the *morale* of considerable numbers of people."[872] In concluding his powerful debunking of the book, Ley illustrated an airplane of the future as imagined by Seversky. It included five heat rays, four secret weapons, two disintegrator ray projectors, a movie projector, six atomic motors and a "pilot, just for emergencies, mechanical brain does all the thinking."[873]

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[867] Willy Ley, "Debunking Seversky's 'Victory Through Air Power,'" *PM*, December 8, 1942, 2-5.
[868] Ibid., 2.
[869] Ibid.
[870] Ibid.
[871] Ibid., 3.
[872] Ibid., 4.
[873] Ibid., 5.

A few days later, *PM* published a one-page response from Quincy Howe, the editor of Simon and Schuster.[874] It contained a rather weak defense of the book, along with an attack on Ley for getting a few facts wrong and comparing the book to *Mein Kampf*. Ley responded to the article by stating, "I am surprised the passing mention of *Mein Kampf* hurt so much. It is nevertheless a fact that young air power enthusiasts quote Seversky in precisely the same manner as ardent young Nazis quote Hitler."[875]

Following this incident, Ley received an Order to Report for Induction in January of 1943. Unlike his editor at *PM*, Ley displayed no moral qualms about joining the United States Army. He may have even considered it an opportunity both to apply his expertise and demonstrate his loyalty to the United States. He was still an "enemy alien." In a letter to editor Frederik Pohl, Ley casually stated, "PS. I'm reporting for inducting Thursday. So Long… unless I am rejected because of poor eyesight."[876] Pohl replied, "Best of luck to you in the Army, Mr. Ley, should you be accepted."[877] After twice reporting to the induction center, Ley received a physical exam. In a different letter to Heinlein, Ley recalled his experience: "As for the Army, I was in it for precisely four hours, the time it took them to put me in 4F because of poor eyesight."[878]

After this rejection, Ley continued to write many more "war weapons" articles, most of which contained illustrations and diagrams that dissected grenades, mortars, mines, and guns, while explaining their evolution as the technological means of

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[874] Quincy Howe, "Publishers of 'Victory Through Air Power' Answer Willy Ley," *PM*, December 11, 1942, 21.
[875] Willy Ley, "Willy Ley's Reply" *PM*, December, 11, 1942, 21.
[876] Ley to Pohl, January 18, 1943, FPP, Box 7, "Correspondence with Dr. Willy Ley."
[877] Pohl to Ley, January 19, 1943, FPP, Box 7, "Correspondence with Dr. Willy Ley."
[878] In this letter, Ley describes his first day of reporting, in which he was asked if he could leave for camp on that day. Ley said that he could not do so. "Two weeks later," he wrote, "I reported again… and that ended with rejection." Ley to Heinlein, March 10, 1943, HA, Box 220-1, "Personal Correspondence, 1943-1971."

warfare.[879] Other articles focused on new developments that might be seen in the coming months. On rockets, in particular, Ley wrote: "rockets have almost become a symbol of new weapons to be feared. Hitler's Danzig speech, which darkly hinted at 'secret weapons' of the Germans, was widely interpreted as referring to war rockets."[880] In other articles for *PM*, he simply educated the public about the physics of shrapnel, the limitations of germ warfare, and the effectiveness of searchlights.

At every conceivable opportunity, Ley tried to debunk "Propaganda Weapons" of the Nazis.[881] For example, in "War Weapons: Nazis May Use Gas to Test Its Terror Effect," Ley weighed in on reports that Germans were testing certain poison gases on the Eastern Front. "Many observers," he explained, "believe that it was the beginning of a large scale use of gas… But it is at least as likely that it was just a test application of poison gas, staged not for any direct military reasons but to the benefit of the analysts in the German Dept. of Psychological Warfare or the German Ministry of Propaganda."[882] Ley devoted his next eight articles on gases and the defense against gas bombs. While

[879] Again, Ley's articles are too numerous to list. However, see these notable examples: Willy Ley, "German Siege Guns of the Two World Wars," *Coast Artillery Journal*, January-February 1943, 13-20; Will Ley, "Rocket Guns, Latest Weapons," *Science Digest*, November 1943, 84-86; For significant articles in *PM*, see Willy Ley, "War Weapons: German Guns Reflect World War I," January 10, 1943, 7; "Science Piles Up Gadgets for Peace," January 15, 1943, 7; "Inventors are Busy on Anti-Submarine Devices," February 15, 1943, 3-5; "Air Umbrella for Invasion Possible," April 25, 1943, 14-15; "How the Mysterious Bazooka Blasts," September 24, 1943, 13; "Rifle Grenade Reborn in World War II," October 20, 1943, 12; "British Are Correcting Artillery Defects," December 3, 1943, 6; "Allied 'Rocket' Plane Is First to Work—Axis Attempts Were Feeble," January 10, 1944, 10-11; "History's Repeating in the Battle for Pskov," February 22, 1944, 14-15; Ley also wrote a long series of "Our Fighting Ships" articles during the month of March, 1944.

[880] Willy Ley, "War Weapons IX: Rockets," *PM*, January 16, 1942, 20. See also, Willy Ley, "Rocket Artillery," *Astounding Science Fiction*, April 1944, 104-116.

[881] See, for example, Willy Ley, "Nazi's Super Submarine, Too, Is Only Propaganda," *PM*, November 23, 1943, 12-13.

[882] Willy Ley, "War Weapons: Nazi May Use Gas to Test Its Terror Effect," *PM*, May 15, 1942, 9.

he doubted the effectiveness of gas bombs, he provided the public with basic steps on "How to Fight Poison Gas," should such an ineffective weapon be used.[883]

Ley's writings made an impact on the publishing scene of New York City. The editors of *Mechanix Illustrated* labeled him "War Weapons Expert" while stating, "These articles and his best-selling book of last fall, *Bombs and Bombing*, have been so widely hailed as definitive discussions… that MECHANIX ILLUSTRATED asked him to devise and describe the weapon which in his estimation could stop the tank terror."[884] Ley used this opportunity to contribute regularly for the magazine, which published more of his articles on "war rockets" and "super guns."[885] He also contributed articles to *Astounding Science Fiction*, including "Bombing is a Fine Art," "The Paris Gun," and "Terry Bull's Terrible Weapon."[886]

Ley took pride in his public service as an educator who could reassure readers by making them understand the scientific and technological facts about the current war. He also took pride in his ability to dispel hysteria, while exposing the "experts" who acted as war profiteers by frightening a general public that was eager for information and predictions. If his readers were presented with the contemporary and historical facts, then they would realize that there was no reason to panic. By 1943, Ley must have felt an enormous amount of pride for his public service. Germany was losing the

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[883] Willy Ley, "War Weapons: How to Fight Poison Gas," *PM*, June 2, 1942, 5.
[884] "Table of Contents," *Mechanix Illustrated*, June 1942, 4.
[885] See Willy Ley, "The Fish that Spits in Your Eye: Submarine Anti-Aircraft," *Mechanix Illustrated*, May 1943, 54-57, 157; "Why Lop-Sided Airplanes?" July 1943, 44-45, 150; "The ABC of Rockets, part 1," September 1943, 58-61, 160; "The ABC of Rockets, part 2," October 1943, 51-53, 156-157; "Flying Guns," December 1943, 64-66, 156; "The 'Squirt'," April 1944, 68-70; "Long Tom," June 1944, 68-70, 151; "Bombs vs. Shells," August 1944, 44-46, 149-150;
[886] See Willy Ley, "Bombing is a Fine Art," *Astounding Science Fiction*, August 1942, 75-83; "The Paris Gun," October 1942: 50-55; For other wartime articles in *Astounding*, see "Torpedo!" July 1944, 113-123; "Rocket Artillery," April 1944, 104-116.

war, and most Americans were less apprehensive. All talk of "terror weapons" under development was sheer nonsense.[887]

Rockets as a Future of Travel

In this context, Ley thrived as a professional writer and public educator. 1944 also marked several important and happy events in Ley's personal life. On March 11th, Olga gave birth to a daughter, named Sandra. At the age of 38, Ley became a father. Three days later, he became an American citizen.[888] Ley finally felt secure. Not only was he enjoying a successful career as a public educator, but he was also making much progress on a memoir of sorts. Most likely, this autobiographical book began as a two-part article for *Astounding Science-Fiction*. In "The End of the Rocket Society" he recalled the rise and fall of the VfR.[889] By the Spring of 1944, this autobiographical account of the VfR had grown into a definitive history of rockets. He titled the first edition *Rockets: The Future of Travel Beyond the Stratosphere*.[890] Willy dedicated the book to Olga. Although this book was not an instant hit, it would become one of Ley's most influential and popular books. From 1944 to his death in 1969, this book expanded from 271 pages to 557 pages. 21 editions were released. It also became an international seller, translated into nearly every European language, including Norwegian. No doubt

[887] For Ley's coverage of the V-1, see Willy Ley, "Invasion 'Outflanked' German Secret Weapon," *PM*, June 20, 1944, 7; Willy Ley, "Future of the Robot Bomb," *Mechanix Illustrated*, November 1944, 35-37, 142,144. See also, "Rocket Artillery," cited in previous footnote.
[888] Date of naturalization taken from FBI file, "Request for Investigation," January 4, 1951. This document illustrates a standard background check following Ley's attempts to contribute to Voice of America. For the most part the FBI files contain no surprises, beyond a few disreputable sources that claimed that Ley's politics were radically leftist. The FBI dismissed such information.
[889] Willy Ley, "The End of the Rocket Society," *Astounding Science Fiction*, August and September, 1943.
[890] Willy Ley, *Rockets: The Future of Travel Beyond the Stratosphere* (New York: The Viking Press, 1944).

the immediate success of this book in English-speaking countries was due to an event that Ley did not directly experience: the V-2 rocket bombardment of London.

Rockets presented a definitive history of rocketry, from early theories of a plurality of worlds to recent engineering accomplishments. Ley wrote:

> It is the story of a great dream, if you wish, which probably began many centuries ago on the islands off the coast of Greece. It has been dreamt again and again ever since, on meadows under a starry sky, behind the eyepieces of large telescopes in quiet observatories on top of a mountain in the Arizona desert or in the wooded hills near the European capitals. It has been dreamt all over the earth, in places ranging from quiet libraries to noisy machine shops. And everyone who thought about that dream added a little knowledge.[891]

Ley wrote: "It is also a story of continuous progress, one small step here and another one there."[892] Not only was it a story of a dream, but also it was the history of a technology that "evoked different ideas in the minds of people at different times."[893] According to Ley, the rocket had long fluctuated between two extremes: "the grim weapon of war and the instrument of amusement in a carefree period."[894] Yet, this dual identity was suddenly "unimportant" for Ley.[895] A new era of scientific exploration had dawned. Although "there will be war rockets and amusement rockets in the future too… there will be bigger and more important applications than either of these two."[896] Writing many months before the V-2 rockets fell on London, Ley predicted, "And as for war rockets, in spite of some spectacular applications in the present war most of their

[891] Ibid., 3.
[892] Ibid.
[893] Ibid., 1.
[894] Ibid.
[895] Ibid.
[896] Ibid.

story lies in the past."[897] Ley concluded, "I'm going to speak about spaceships. Some time in the future they'll exist."[898]

What follows is an entertaining romp through the history of science. It is perhaps one of the most Euro-centric histories of a plurality of worlds. Whereas the Babylonian "conceptions were childish," while Chinese astronomers "did not even guess that the lights in the sky which they observed so diligently might be other worlds," it was up to Greeks "to invent better concepts, concepts which coincided to a large extent with reality and served as a starting point."[899] While the Greeks "almost succeeded in arriving at a true picture of the solar system," their philosophical speculations complemented their astronomical observations.[900] Unfortunately, scientific progress was severely "handicapped" by Aristotle and generations of his followers:

> It literally came to a point where thinkers set out with the notion that all wisdom could be found in the Bible, all astronomy in the Almagest, and all science in the writings of Aristotle. Not only was it simply forbidden to teach anything that contradicted or diverged from Aristotle's statements, it was also denied that there was anything that Aristotle had not known.[901]

Due to close-minded adherence to a learned authority, science was at a standstill. It would remain stagnant until "the astronomical revolution" of Copernicus, who created "a new picture of the world," further developed by Galileo and Kepler.[902] Ley then ruminates on Kepler's science-fantasy, *Somnium*, to illustrate "the new telescopic era which dawned."[903] It was a new age of rediscovered texts and experimentation. It is also a new age of fantasy and science fiction. For Ley, these two trends were deeply

[897] Ibid., 4.
[898] Ibid.
[899] Ibid., 6-7.
[900] Ibid., 7.
[901] Ibid., 10.
[902] Ibid., 14-15.
[903] Ibid., 16-19.

connected as the idea of plurality spread throughout Protestant countries. Yet, soon the idea of travel was dealt two almost fatal blows: The maps of Hevelius illustrated a dead moon in 1647 and Cassini discovered that the distance between the sun and the earth exceeded 80 million miles.[904] "Things had suddenly grown too large, too impressive, for light-headed speculation on actual travel," Ley concluded.[905]

Fortunately, the nineteenth century included "the decades of great dreams."[906] It is fascinating that Ley connected the history of astronomy to the history of newsprint, which continuously stimulated readers with hoaxes and astronomical wonders. The most dramatic was Sir John Herschel's alleged discovery of vegetation, unicorns, and "bat-men and bat-women" on the moon.[907] The hoax had been printed in 1835 in the New York based daily, *The Sun*, which saw it circulation rise to 19,300 copies, far more than the *London Times*. Astronomical discoveries could be profitable for newspapers. "For a while New Yorkers were indignant," Ley wrote, "then they began to laugh... and the 'Panorama' exhibits and the stage began capitalizing on… [the] great moon hoax."[908] Then came the actual astronomical discoveries of astronomers during the late nineteenth century: a primordial Venus and an advanced Mars, crisscrossed by strange "canals." Suddenly, "the nineteenth century became the era of the greatest astronomical dreams."[909] Ley clearly enjoyed dissecting the competing hypotheses of life on other worlds, while discussing the evidence. At times he distinguished between "crackpots" and "astronomers." Nevertheless, popular science and popular literature complemented

[904] Ibid., 25-27.
[905] Ibid., 26.
[906] Ibid., 28.
[907] Ibid., 28-30.
[908] Ibid., 31.
[909] Ibid., 32.

each other. Ley claimed: "Schiaparelli's first announcement was followed by three decades of Mars enthusiasm, three decades during which reports from astronomical observation were awaited and read as avidly as reports from the front in the middle of a war."[910] He added, "It goes without saying that literature did not fail to contribute to these decades of the great dreams."[911]

By the early twentieth century, new astronomical discoveries, as well as the debunking of earlier theories discouraged many of these dreams. By the 1920s, Mars was "out of the running" and Venus was "somewhat too warm" when it came to intelligent life.[912] Still, the dream of the human conquest of space lived on, with imagined journeys to nearby worlds. Newer novelists were "confronted" with new scientific evidence, forcing them to "let the conquest of space originate from earth."[913] "The chances are overwhelming," Ley argued, "that future developments will prove them correct."[914]

The remainder of the book presented a detailed history and discussion of rockets, as well as a biographical account of the VfR. In clear and direct language, Ley explained the how, why, and when of rockets, from ancient Chinese powder rockets to liquid-fuel designs of the late 1920s. He also evaluated the contributions of different theorists and engineers, with the aim of establishing a clear chain of events regarding the development and progression of the "science."

The most dramatic chapters are called "The Battle of the Formulae" and "Success, Failure, and Politics," which read like a tell-all history of the VfR,

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[910] Ibid., 48.
[911] Ibid.
[912] Ibid., 52.
[913] Ibid., 53.
[914] Ibid.

Rakentflugplatz Berlin, and the eventual decline of rocket experimentation in Germany. Overall, the rise of Nazis killed the scientific movement, forcing Ley and others, such as Herbert Schaefer, to flee Germany. In a footnote, Ley even claims, "I have it in writing from his own hand that… [Oberth] denounced me to his Nazi superior, stressing the fact that I was in correspondence with Ziolkovsky, Rynin, and Dr. Perelman."[915] For future innovation in rocketry, politics had to get out of the way of such nationalistic nonsense.

The final chapters of the book discussed possible future innovations of rockets, from meteorological instruments to cosmic voyages. The discussion concluded with an answer to the question of "Why should we try for space travel?"[916] The "simple answer" is presented: "Somebody has got to start at some time, and we may as well get the glory for our own century."[917] Ley then reassured readers:

> It can be added that developments of this type very often progress much more smoothly than expected as soon as the initial difficulties have been overcome… We know about them and we know *when* they will be overcome. The space rocket will be simple once the meteorological rocket has passed the 200,000-foot altitude mark. So much is certain right now.[918]

Ley also stressed that the costs of the first journey would be offset by the sale of lunar material. "[A]nything lunar," he predicts, "will bring fabulous prices… [b]ut only once."[919] While the ultimate pay out is the knowledge of discovery, Ley further predicted that the discoveries made on a station in space could possibly "pay for everything."[920]

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[915] Ibid., 122.
[916] Ibid., 148-149.
[917] Ibid., 248.
[918] Ibid.
[919] Ibid., 249.
[920] Ibid.

Reception and Reaction

Initially, Viking Press did not heavily promote the book, beyond a few small advertisements in newspapers.[921] The book met with an enthusiast, albeit limited reception. Most notably, science writer Waldemar Kaempffert reviewed it for the *New York Times*. "Though the head of Willy Ley may be somewhere in interstellar space," Kaempffert asserted, "his feet are on the earth."[922] While Kaempffert commended the thoroughness of the discussion of rockets, he took issue with Ley's optimism.[923] Kaempffert also critiqued Ley's interpretation of the history of science, implying that it was absurd to attribute the lack of medieval scientific progress to an absence of skepticism in the world. Nevertheless, Kaempffert and others kindly reviewed the merits of the text, while sharing in Ley's excitement for the future.[924] *Newsweek* even remarked on Ley's obsession with rockets after arriving in the United States:

> Scoffing didn't bother Ley. His thinking was miles ahead of actual rocket development then or now, but his predictions were sublimely confident. The propulsion rocket seemed to him to be the vessel by which man might travel to the moon. So for nine years after his arrival in New York the earnest, bespectacled scientist talked and wrote spaceship. He became known as one who wanted to shoot the moon in the fantastic manner of a Jules Verne hero.[925]

Otherwise, the book had a fairly limited reception. Astronomer Robert S. Richardson reviewed it in *Publications of the Astronomical Society of the Pacific*, calling the rocket

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[921] "Display Ad 116," *NYT*, May 21, 1944, BR9. These ads proclaimed that the text told "the exciting history of a daring dream and how it may come true!"
[922] Waldemar Kaempffert, "Ranging Beyond the Stratosphere," *NYT*, May 21, 1944, BR4.
[923] Ibid. Kaempffert argued: "Though he disposes of the dangers and difficulties of astronautics convincingly, it seems to this reviewer that he has underestimated the physiological risk run in a spaceship by a man whose organs are no longer subject to what we call 'weight.'"
[924] See "Rocket to the Moon: Scientist Says Experiments May Make Dream a Fact," *Newsweek*, May 22, 1944, 80; Freeman Cleaves, "Out of This World," *Wall Street Journal*, July 20, 1944, 6.
[925] *Newsweek*, 80. See also, "Glimpses of the Moon," *Time*, July 31, 1944, 70-72.

"perhaps the most exciting machine in modern science."[926] Additionally, Ley's tell-all chapters on the VfR "read like a novel."[927] Overall, this reviewer described the book as "a masterful and fascinating account of fact more exciting than fiction."[928] The technology inspired awe and wonder.

Robots and Rumors

Ley continued to write articles on traditional war weapons for *PM* and *Mechanix Illustrated*.[929] Given the broader context, newsprint coverage focused less on technologies of the future and more on the mysteries surrounding new "robot bombs" that fell mostly on London. Ley's book may have indirectly influenced certain reporters to speculate about Hermann Oberth's role as "the man who perfected Hitler's flying bomb."[930] Other reports included striking headlines, such as "Robots Kill 2,752."[931]

Although Ley was as curious as other reporters, he tried to calm the readers of *Mechanix Illustrated* with an article titled, "Future of the Robot Bomb."[932] This piece was probably written in early September of 1944, at exactly the moment when V-2 rockets began to hit London. Ley seems quite unaware of reports about these new rockets. Likely, any reports were conflicting, often filed under the heading of never ending rumors of Hitler's "secret weapon." In this article, Ley based much of his evaluation on existing accounts of V-1 "flying bombs."

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[926] Robert S. Richardson, "Review" *Publications of the Astronomical Society of the Pacific* 56:330 (June, 1944): 134.
[927] Ibid.
[928] Ibid.
[929] See, for example, Ley, "Bombs vs. Shells," *Mechanix Illustrated*, August 1944, 44-46, 149-150.
[930] "Here he is—the German who perfected Hitler's flying bomb," *London Daily Mail*, July 5, 1944, 4.
[931] "Robots Kill 2,752," *Pittsburgh Sun-Telegraph*, July 6, 1944, front page.
[932] Willy Ley, "Future of the Robot Bomb," *Mechanix Illustrated*, November 1944, 35-37, 142-144.

Ley began, "The German flying bomb is a weapon of paradoxes."[933] In a sharp tone, Ley evaluates the reports: "It is novel, yet the idea is by no means new. It is crude and inaccurate, yet it is destructive. It has no military value in the present war and will not delay the fall of Berlin by a single day, yet it may be the dominant weapon of future wars."[934] Although the robot bombs were simply "too new" and "not quite out of the laboratory stage," they could serve as the "means of preventing any future German aggression."[935] Ley also speculated on the ways in which the V-1 could be improved through enlargement and the elimination of launch sites that could be bombed. With an increased frequency of launches, these "very heavy and… very long range" aerial torpedoes may become dominant technologies of war. "Naturally they would not win the war by themselves, not any more than any other weapon," Ley argued, "but they might be dominant in about the same sense as the airplane is the dominant weapon of the present war: it cannot win by itself, but you cannot do without it."[936] These thoughts led Ley to the final paradox:

> While full of future possibilities the robot bombs of the Nazis did not accomplish anything from the military point of view simply because they were not sufficiently developed. And the Nazis had, in effect, lost the war before they even built the first launching ramp. After the war this weapon may see to it that future generations of Nazis cannot start another war… The flying bomb in itself might be enough of a threat… and those Germans, who, in the future, do plan war, will have to console themselves with the thought that they cannot make war because of a German invention.[937]

This passage is yet another example of Ley's contradictory statements regarding the military potential of rocket technology. One thing was certain: By the fall of 1944, the

[933] Ibid., 35
[934] Ibid.
[935] Ibid., 35.
[936] Ibid., 142.
[937] Ibid., 142-144.

German war effort was a hopeless campaign against inevitable defeat. No weapon of propaganda would save a totalitarian regime.

The Shock of V-2

Throughout the month of September and October, news reports and other rumors circulated. A mysterious new weapon rained down upon London, and eyewitnesses came forward to provide their personal accounts. During this period, Ley received a visit from A. V. Cleaver, an aviation businessman and member of the British Interplanetary Society. Cleaver claimed to have inside knowledge about these new wonder weapons: they were large rocket missiles. Ley dismissed the rumors entirely. Cleaver recalled:

> I was astonished to find that, for some reason, he had decided that the rumours were a lot of nonsense. He spent much time and effort assuring me that his ex-countrymen were most unlikely to have developed such a weapon, which would be inaccurate and uneconomical, and probably impossible to achieve at that date, in any case. I argued weakly against these conclusions but being very conscious of war-time security and of my own youth and junior position, I forbore to tell him that I had personally heard the "rumours" arriving, with their characteristic double bangs, or that I could describe the rocket to him if he would only listen![938]

Other accounts claim that Ley, once he believed the rumors, asserted that Wernher von Braun was the man behind the V-2 rocket. For example, a different letter from Cleaver to von Braun ended with this statement: "[Ley] then said that, if the rumors were true, 'a young man called von Braun' might be responsible."[939]

Historians of technology have often expressed a sense of surprise that Ley did not believe reports of V-2 rockets until November when both Churchill and Hitler spoke

[938] A. V. Cleaver, "Tribute to Willy Ley," *Spaceflight*, November 1969, 408.
[939] Quoted in Ward, *Dr. Space*, 43. Source is listed as "A. V. 'Val' Cleaver, letter, February 16, 1972, 'X = 60 and Counting.'"

publicly about the technology.[940] Even then, Ley had many doubts about conflicting reports, rumors, and eyewitness accounts. Historians have wondered how Ley, as a "prophet" of the Space Age, could have been so blindsided by the V-2 and doubtful of its existence.

The question is not difficult to answer, given the fact that an expert on war weapons had every reason to doubt the effectiveness and military value of a long-range missile in 1944. In fact, as historians have shown, the V-2 was one of Hitler greatest blunders. Not only did more people die during the production of the weapons than during their deployment, but also the V-2 was generally ineffective even as a psychological means of warfare. To quote Michael J. Neufeld:

> Since the German war economy was significantly smaller than the American one at its peak, the Army rocket program imposed a burden on the Third Reich roughly equivalent to that of Manhattan on the United States. Such a comparison makes it almost superfluous to explain why the German Army rocket program was, in military terms, a boondoggle. Even compared with Anglo-American conventional strategic bombing, the V-2's results were pathetic. The total explosive load of all A-4s fired in anger was scarcely more than a single large RAF air raid! Moreover, the 5,000 Allied civilians killed by V-2 attacks (leaving the prisoners aside) were dwarfed by many tens of thousands of dead in single raids on Hamburg, Dresden, and Tokyo, not to mention Hiroshima and Nagasaki.[941]

Although Ley lacked this retrospective and historical insight, he had legitimate reasons to be skeptical of the effectiveness of an inaccurate missile with a small payload. It must have seemed like the Nazis turned to fire arrows amidst fire bombings. No known payload could justify the military value of war rockets.

Most likely, Ley received requests for articles, yet he did not immediately comment. A notable exception occurred in he January edition of *Technology Review*.

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[940] See, for example, "Churchill Admits Giant V-2 Rockets Hit Britain," *New York World Telegram*, November 10, 1944, front page.
[941] Neufeld, *The Rocket and the Reich*, 273.

Ley casually argued, "The military value of this weapon is small… any hit scored by the V-2 is purely accidental and completely unpredictable."[942] Ley added, "the effect of the one-ton war head is actually less than that of the same war head when attached to the V-1."[943] He concluded: "V-2, therefore can be characterized as an extraordinary example of engineering and research but also as a military flop… V-2 lacks accuracy, completely; it is not even capable of hitting such a target as a large city when fired at extreme range."[944]

Aside from this short article, Ley became reluctant to comment on the V-2, which may explain why *Mechanix Illustrated* relied upon Harry Botsford in its June 1945 issue.[945] Ley spent many weeks simply collecting information. Then, he came forward with an exclusive article for *Astounding*. The editor introduced the article, "V-2 Rocket Cargo Ship," by claiming, "Willy Ley knows rockets—and German rocket engineers. He can, and does, identify the man who designed V-2."[946] Ley begins the article by asserting, "The full story of the German rocket research laboratory near Peenemünde… will never be written. There will be nobody alive who can write it. Most of those who knew the full story are dead already, those that are still alive will die before the war is over."[947]

The article also demonstrates just how little he knew about von Braun's work at Kummersdorf and the Army Ordnance's support in late 1932. Arguably, the piece completely discredits Cleaver's story, which has been repeated in many biographies of

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[942] Willy Ley, "Notes on Weapons: V-2, V-1, Me-163, among Recent Additions to the Alphabet of War, Offer a Varied Story," *Technology Review*, January 1945, 169.
[943] Ibid.
[944] Ibid.
[945] See Harry Botsford, "The Rockets Rain Down," *Mechanix Illustrated*, June 1945, 47-49.
[946] Willy Ley, "V-2 Rocket Cargo Ship," *Astounding Science Fiction*, May 1945, 100.
[947] Ibid., 100.

von Braun. Ley recalled, "At the time Hitler was actually coming to power no rocket research went on anywhere in Germany and this state of affairs was to prevail for another three years."[948] The situation changed in 1937 when Hermann Oberth "established… contact with the Germany Army." Soon, at Peenemünde, "Oberth… probably was the department head of the V-2 branch."[949] Ley then recounted newsprint stories and other information about the V-2, its design, and its fuel. "Everything about it spells out OBERTH in capital letters," Ley concluded.[950]

On the V-2 pump system, Ley argued, "With such pumps you can, given a little time, even build a spaceship… As a matter of fact… Yes, we might as well admit it, V-2 is the first spaceship."[951] The article ends on a pessimistic note: "We cannot hope to take Peenemünde… The Nazis will see to it that everything will be utterly destroyed before we get there. And Himmler, I am sure, has lists of all those who know a good deal about this work. If they escape future Allied bombings, they will be shot by the Gestapo."[952] Lastly, Ley argued, "Barring miracles we will not be able to continue for peaceful purposes what the Germans started with war in mind. But the recreation of these things can be undertaken with confidence after the war, because Peenemünde proved that it can be done."[953] The United States would need a rocket expert to recreate the results.

The Science Writers and the Second World War

[948] Ibid., 104.
[949] Ibid., 110.
[950] Ibid., 121.
[951] Ibid., 122.
[952] Ibid.
[953] Ibid.

Ley was not unique in his role as a science writer and public educator. He was part of an emerging profession of freelancers, scientific historians, and editors who had enlisted in a broader fight against totalitarianism, public hysteria, and uninformed irrationalism. In order to put Ley's writings and activities into a broader context, it is necessary to examine the commonalities between his efforts to educate and a broader crusade that united many different scientific intellectuals. By taking a retrospective look at the careers and activities of other writers and historians of science, Ley's relationship to a larger intellectual scene becomes obvious.

When war engulfed Europe, some historians of science restated their cause. In particular, George Sarton announced in the journal *Isis*: 'In the face of the moral and social chaos endangering the whole world it is more necessary than ever to study… our most precious heritage, the heritage not of one nation but of the whole mankind."[954] *Isis*, as a journal devoted to the history of science, was not simply aimed at a better understanding of past contributions of scientists. He explained: "The purpose of *Isis* is to explain our past efforts in that direction and thus help to continue them in the same spirit of devotion to truth and humanity."[955] The scientist, as witnessed in the past, could be a crusader for this cause. He could proclaim truth and save humanity. The historian of science could further celebrate the past crusaders, who cast light upon the darkness. "In the shadow of so many crimes and sufferings," Sarton elaborated, "can there be a greater consolation than to study and explain more clearly the best and

[954] George Sarton, "Preface to Volume XXXIII: To the Republic of Letters," *Isis* 33 (March, 1941): 3.
[955] Ibid.

highest deeds of the people of every nation and thus to vindicate the goodness of man?"[956]

Other historians and scientists advocated a more direct route. M. F. Ashley Montagu wrote: "It is untrue that science is unpolitical. Everything is political."[957] The role of the American scientist was clear:

> Those of us who enjoy the privilege of living and working as citizens of the United States must learn from the errors of the Europeans that scientists must become active in the government of the society in which they live, and not look upon politics as something from which both their lives and their work are divorced. For what they can contribute to the development of that society is of paramount importance, and they must make up their minds whether the privileges they enjoy do not entail certain duties, for if there are certain ills in our society which they are more competent to remedy than others, then they must organize so that their combined voices may be heard…"[958]

Here, Montagu exemplified a scientist who embraced a crusade to educate a mass audience through popular writing. Scientists must "convince their fellows of the value of the contribution which they have to offer."[959] They must enlighten the society in which they live. Only under their guidance and direction can that society progress towards a better, safer, and more rational future.

Montagu's campaign to educate, enlighten and liberate American minds can be read in his most popular book, *Man's Most Dangerous Myth: The Fallacy of Race* (1942). The book was a no-holds-barred attack on Nazi pseudoscience and American racism.[960] One reviewer labeled it the "most recent, devastating and thoroughly

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[956] Ibid., 3.
[957] M. F. Ashley Montagu, "Review of *Adventures of a Biologist* by J. B. S. Haldane," *Isis* 33 (June 1941): 298.
[958] Ibid.
[959] Ibid.
[960] M.F. Ashley Montagu, *Man's Most Dangerous Myth: The Fallacy of Race* (New York: Columbia University Press, 1942). Montagu also wrote books that could be regarded as "self-help" literature. See, for example, Montagu, *How to Find Happiness and Keep It* (Garden City, N.Y.: Doubleday, 1942). See also, *The Cultured Man* (1958) and *The Humanization of Man* (1962). On Montagu's feminism, see *The Natural Superiority of Women* (1953).

scientific book ever written on race."[961] Montagu stated, "This book then is designed to expose the most dangerous myth of our age, the myth of 'race,' by demonstrating the falsities of which it is compounded."[962] Science proves, Montagu asserted, "the fundamental unity of all mankind."[963] He added: "Clearly, any culture or part of a culture which finds it necessary to create and maintain hostilities between different groups of men, instead of encouraging their social development by mutual exchange and cooperation of interests to the advantage of all, is sick."[964] A sick culture must heal itself. The diseases of bigotry, intolerance, and racism must be purged from the body politic. Scientific thinking served as a cure.

Montagu also relentlessly challenged his colleagues to entirely drop the word "race" from their anthropological vocabulary. Montagu's challenge to anthropologists made headlines, particularly in the South.[965] He could be equally provocative when calling for other fundamental alterations to the human condition. For example, in "War and the Myth of Nature," Montagu skillfully debunked the "universal law of Nature" that stressed competition and survival of the fittest.[966] There was nothing natural about war in 1942. Man was not inherently violent and unintelligent. Instead, "he is a victim, alas, of the two-handed engine of his culture which distorts his mind and renders him unintelligent."[967] In a passage that reflected his passion, style, and beliefs, Montagu asserted: "Outworn traditional teachings have made of Western man a shockingly unintelligent creature who lives under the continuous and unrelieved domination of a

[961] "Looks at Books," *The Pittsburgh Courier*, January 23, 1943, 7.
[962] Montagu, *Man's Most Dangerous Myth*, 14.
[963] Ibid., 15.
[964] Ibid., 355.
[965] "Anthropologist Asserts Race Terms Have No Real Meaning," *Atlanta Daily World*, April 20, 1941, 5.
[966] M.F. Ashley Montagu, "The Nature of War and the Myth of Nature," *Science* 54 (1942): 342-353.
[967] Ibid., 347-348.

chaos of ideas more degrading, more stupid, more idiotic and more saddening than it may ever be possible to describe."[968] Montagu placed most of the blame on a "confused" and unscientific "morality," which has transformed "Western man" into a "function almost entirely of the reigning spirit of confusion and prejudice."[969]

Although tradition and irrational beliefs showcased the brutality of man, as seen in the present war, there was hope for a better future. Culture could change, especially if fallacies are forcefully debunked for all to see. "If man is to be saved from himself before it is too late," he wrote, "this tyranny [of tradition] must be broken, and this can only be achieved by the unequivocal that must follow upon the reasoned dissolution of such errors of belief and thought as form so great a part of our traditional social heritage to-day."[970] Scientists could mobilize to enlighten and educate the masses, just as they had mobilized for war. With continued mobilization during the postwar years, there were tremendous opportunities to reshape culture.[971] Montagu also recognized that the history of science could be used as a tool for public education.[972] As a reviewer observed, his wartime and postwar writings attempted "not only to popularize but also to re-educate morally."[973]

Other historians, science writers, and public intellectuals echoed these sentiments as they used science as a weapon in a *Kulturkämpfe*. Historian David A. Hollinger described a camp of diverse New York intellectuals who came together to

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[968] Ibid., 348.
[969] Ibid.
[970] Ibid., 353.
[971] See, for example, Montagu's review of Morris Fishbein's *Doctors at War*: M.F. Ashley Montagu, "Calling All Doctors," *NYT*, May 20, 1945, BR4. See also, M.F. Ashley Montagu, "Wartime Miracles," *NYT*, March 19, 1944, BR12.
[972] See *Studies and Essays in the History of Science and Learning Offered in Homage to George Sarton on the Occasion of His Sixtieth Birthday, 31 August 1944*, ed. Ashley Montagu (New York: Schuman, 1944).
[973] Alicja Iwanska, "Popular Science and Race," *Phylon* 14 (1953): 98.

participate in a broader cause. From philosopher Karl Popper to cultural anthropologist Margaret Mead, these intellectuals shared many similar goals. In their cultural struggle, defending science and democracy became a shared endeavor to save the American public from both foreign and domestic threats. Hollinger argued:

> These men and women saw themselves not simply as supporters of democracy's fight for survival against the international fascist menace, but as the guarantors of a particular vision of democracy, one authentically Jeffersonian, but being subverted by the perpetuation of old-fashioned religious and ethnic prejudices and being inhibited by a psychologically immature and socially provincial predilection for absolutes that portended an authoritarian political culture in the United States.[974]

Many of these intellectuals waged a war that defended democracy and science against the spread of a "generalized" totalitarianism that was present in both fascism and communism. They contrasted the open, public and democratic aspects of science to the closed worlds of both aristocratic and totalitarian authoritarianism. A rational democracy relied on the type of thinking that promoted open-mindedness, critical thought, objective evaluation, and informed consent. Science relied on democratic values and practices. Conversely, totalitarianism relied on obedience and a closed system.

Science writer Waldemar Kaempffert made similar claims during the Second World War. Just as Ley educated the readers of *PM*, Kaempffert worked diligently for the *New York Times,* in which he sought to educate and enlighten the general public.[975]

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[974] Hollinger, "Science as a Weapon," 444.

[975] Kaempffert's activities were not confined to the *New York Times*, where he served as science writer. For general works, see Waldemar Kaempffert, *What We Know About Mars* (New York: McClure, 1907); *Astronomy* (New York: Current Literature, 1909); *The New Art of Flying* (New York: Dodd, Mead, and Co., 1911); *The Book of Modern Marvels* (New York: Leslie-Judge Company, 1917); *Collier's Wonder Book* (New York: P.F. Collier and Son, 1920); *The A. B. C. of Radio: The Underlying Principles of Wireless Telephony in Simple Language* (New York: Martin H. Ray, 1922); *A Popular History of American Invention* (New York: C. Scribner's Sons, 1924); *Invention and Society* (Chicago: American

One could even read Kaempffert's 1956 obituary as a shared description of Ley: "…he wrote thousands of articles to inform the average reader of the ever-increasing flow of new-found facts of nature. This educative task he performed with lucidity, without bewildering the reader by talking over his head or patronizing him by talking down. Though he often dramatized science, he never tried to sensationalize it."[976]

Both Kaempffert's career as a "science editor" and his popular writings have been greatly understudied. His articles are quite revealing. For example, in late 1940, he contributed an essay to *Foreign Affairs*, titled "Science in the Totalitarian State."[977] The piece began by immediately lumping communism and Nazism together. The commonalities of the regimes far outweighed ideological differences. "Both agree," Kaempffert wrote, "that the university professor must serve the state, accept the tenets of official ideology and eschew any excursions into the metaphysical or the theoretical."[978] He continued, "The artist, philosopher and scientist must not only believe what he is told to believe by his rulers; he must practice that belief. Objectivity is derided in both the Soviet Union and Germany as unattainable and as anti-social."[979] Both regimes sought to crush individuality and impose official dogma. Both regimes sought to eliminate freedom of inquiry and dissent. Under such a regime, the university

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Library Association, 1930); *Science Today and Tomorrow* (New York: Viking, 1945); *Explorations in Science* (New York: Viking, 1953); *The Many Uses of the Atom* (New York: Foreign Policy Association, 1956).

[976] "Waldemar B. Kaempffert Dies; Science Editor of the Times, 79," *NYT*, November 28, 1956, 35. The obituary quotes Kaempffert as saying: "But Heaven forbid that the popularizer should rely too much on emotion. We have passed the stage when gaping wonder can pass for popularization. The facts, simply, humanly and interestingly presented, are what the public wants."

[977] Waldemar Kaempffert, "Science in the Totalitarian State," *Foreign Affairs* 19 (January, 1941): 435-441.

[978] Ibid., 435.

[979] Ibid.

professor could only ask himself one question: "Does my work serve the welfare of National Socialism [or Bolshevism]?"[980]

These ideological blinders led Soviet and German scientists to denounce certain scientific theories. For example, "Relativity was denounced in Nazi Germany before the Hitler-Stalin alliance as a piece of 'Jewish communism;' since the alliance it has become an example of characteristically perverse Jewish thinking. In Soviet Russia relativity is likewise scorned, but as an expression of 'bourgeois idealism.'"[981] Kaempffert then lists several other examples of the ideological manipulation of science in accord with the irrational dogma of the state and its occult teachings. In these settings, the first criterion of science is not the truth. Rather, the first criterion is the theory's compatibility with ideology. After ridiculing key examples and individuals, Kaempffert reasserted, "The totalitarian conception of the relation of science to the state is remarkably elastic. When political expediency so determines, the whole concept is modified."[982] If a scientist attempts to separate "his politics from his strictly professional activities," then "he automatically becomes an anti-Nazi in Germany and a counter-revolutionary in the Soviet Union."[983] Kaempffert listed the ways in which ideology, vehemence, and sheer blood lust had deeply perverted Soviet and German science. He then pleaded for the preservation of science and democracy by equating the two activities: "[If] the dictators are to be overthrown, if democracy is to be preserved, the part that science and technology played in the rise of democracy cannot be

[980] Ibid., 434.
[981] Ibid., 434-435.
[982] Ibid., 436.
[983] Ibid., 437.

ignored."[984] He added, "The democratic method is to adapt social change to technological change. The dictators are trying to do the contrary."[985] Kaempffert made a similar point about science.

Leadership cannot simply adjust science and technology to fit the ideological beliefs of the state. The process is much more organic, bottom up, and democratic. Society adapts itself to new science and technology. His conclusion is clear: "But the point is that science dominates our society, and if our society wants science it must choose between totalitarianism and democracy. There can be no compromise."[986] No self-respecting scientist can believe otherwise. The totalitarians have taken control of machinery, organizations, and research centers. However, in Kaempffert's view, there is nothing that they can do to preserve "the scientific attitude of mind" in their regimes. The scientific attitude must be abandoned to fit with the interests of the state, thus "there can be no Newtons, no Darwins, no Einsteins."[987] Science could only progress in "the fundamental freedom of democracy."[988] "There can be science and engineering under dictation," he summarized, "but it will be stylized science, engineering which does not progress."[989]

For the remainder of the war, Kaempffert's "Science in the News" articles for the *New York Times* continued to make similar ideological points, while other articles took his case further.[990] In most cases, Kaempffert relentlessly campaigned for the

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[984] Ibid., 439.
[985] Ibid.
[986] Ibid.
[987] Ibid., 441.
[988] Ibid.
[989] Ibid.
[990] See, especially, Waldemar Kaempffert, "The Soviet Way: Integrated Research is Made To Serve the State at War," *NYT*, November 7, 1943, E11. This article extends his 1941 claims, yet simultaneously

mobilization of the scientific community. His call to arms can be read in "What are Scientists Doing?" which was Kaempffert's contribution to *America Organizes to Win the War: A Handbook on the American War Effort* [991] As the war progressed, he celebrated the successes of the American scientific front. For example, his article, "American Science Enlists," praised the intellectual struggle in a "totalitarian war."[992] Kaempffert complimented the scientists, public educators, and national leaders who "serve" as "generals" on the frontlines of a war to preserve human freedom, democracy, and science. For the first time, the national mobilization of the scientific community indicated that American leaders recognized that "science is science." Kaempffert also firmly believed that a coordinated effort to mobilize and centralize scientific research would lead to a postwar economic boom. Otherwise, many of Kaempffert's articles sought to keep citizens informed, while simultaneously training them to think scientifically about war and its dangers.[993] Kaempffert also reported optimistically about key developments in science that would aid the war efforts.[994] His "Science in Review" column contained many predictions about the postwar boom in living

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displays anxieties about the total mobilization of science in the Soviet Union. Arguably, there are deep tensions within this perspective.

[991] "What are Scientists Doing?" in *America Organizes to Win the War: A Handbook on the American War Effort* (New York: Harcourt, Brace, and Co., 1942).

[992] Waldemar Kaempffert, "American Science Enlists," *NYT*, November 2, 1941, SM3.

[993] For examples from the *New York Times*, see Waldemar Kaempffert, "Blackout Methods: A Scientific Approach to the Protection of Our Cities," August 9, 1942, E9; "Descriptions of Germany's Rocket Bomb Conflict and Only Deepen the Mystery," June 25, 1944, E9; "Secret Weapon: War Rocket Called One But Its Principle Is Old," July 25, 1943, E11; "The New Weapon: Radio-Controlled Bomb is Unlikely to Help Germans," September 26, 1943, E13; "Science in Review: Germans Developed V-2 Rocket to Overcome Factors Weakening V-1's Effectiveness," November 19, 1944, E9;

[994] See, for example, Waldemar Kaempffert, "Review of Gains Made in Science During Year," *NYT*, December 28, 1942, D7; "War Job Tests: Trials Prove the Skill of Men and Women at Machines," *NYT*, October 25, 1942; For other works of technological optimism, see Waldemar Kaempffert, "The Airplane and Tomorrow's World," *Public Affairs Committee*, 1943; "Science and Our Future: A Radio Discussion," *For This We Fight*, June 12, 1943, 3-11; "Science in Review: Technological Progress Made During the War Should Help Bring Higher Standards of Living, Further Research Indicated," *NYT*, May 20, 1945, E9.

standards. Other works and articles celebrated the postwar possibilities of "total" science during times of peace.[995]

Other science writers operated somewhat independently from specific publications. Notably, Howard W. Blakeslee of the Associated Press served as an influential expert, often educating Americans about the technologies of war and the science behind future applications.[996] Like other science writers, Blakeslee forecast amazing postwar advances that followed the mobilization of the scientific community during the war.[997] Other AP science writers, such as Frank Carey and Rennie Taylor, shared his enthusiasm for the postwar future.[998]

John J. O'Neill led a similar crusade for scientific education in the pages of the *New York Herald Tribune*.[999] As both science editor and president of the National Association of Science Writers, O'Neill campaigned for the mobilization of the scientific community amidst total war. Yet, due to a recent "curb on science" imposed by censorship on work related to Uranium 235, O'Neill warned that the Roosevelt administration "is staging a totalitarian revolution against the American people."[1000]

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[995] See, for example, Waldemar Kaempffert, "Reconstruction," in *Plans for a Post-war World* (New York: H.W. Wilson, 1942); *America's Atomic Bomb: What Shall We Do With It?* (with Jechiel Max Weis) (New York: World Peaceways, 1945); *Should the Government Support Science?* (New York: Public Affairs Committee, 1946);

[996] See, for example, Howard W. Blakeslee, "Facts, Not Propaganda Sway U.S.," *WP*, March 23, 1941, B5; "Blitz Use of Gasses Awaited," *WP*, March 23, 1941, B6; "Weather Vital in Modern Warfare," *WP*, July 6, 1941, B3; "Science Gets New, Strange War Task," *WP*, May 7, 1943, 7; "Sound Waves Kill in Battle, " *WP*, August 10, 1943, 8; "Believe German Weapon Herald of Winged Bomb: Rocket Glider Carries Explosive to Target," *CDT*, September 22, 1943, 10; "Sound Guided Torpedo May Be New Nazi Device," *CDT*, November 2, 1943, 11;

[997] See Howard W. Blakeslee, "Things to Come—They Will Come, Too: Marvels Science Is Predicting Aren't Fancies But Will Take Time," *WP*, May 23, 1943, 18; "'Wonder Era' Promises Homes Lit by Radio, Street Lights in Sky," *WP*, June 26, 1945, B3;

[998] See Frank Carey, "Fight on Insect May Revolutionize Civilian Comfort," *WP*, December 12, 1943, B1;

[999] On general science reporting, see, for example, John J. O'Neill, "Performance Rocket Scare's Best Answer," *WP*, May 19, 1944, B2; "Luminous Paint Being Made for Blackouts," *WP*, January 9, 1942, L6; "Many Planets, Suns Exist, Science Finds," *WP*, August 15, 1943, L6.

[1000] "Writer Charges U.S. with Curb on Science," *NYT*, August 14, 1941, 15.

After stating that scientists had recently discovered a method of releasing large amounts of energy from a single atom, he argued, "Can we trust our politicians and war makers with a weapon like that? The answer is no. Nevertheless, our politicians have taken control of the scientists…"[1001] In O'Neill's perspective, the imposition of secrecy and state-directed science was inimical to the relationship between science and democracy.

While the science writers educated Americans, while debunking myths and propaganda, other scientific intellectuals came together to voice their perspectives. For example, a significant 1943 conference in New York City included various professors, scientific leaders, and directors of institutions. Their papers were published in *The Scientific Spirit and Democratic Faith* (1944). According to editor Eduard C. Lindeman, the book served as "a clear protest against a movement of reaction which seemed to be inimical to both democracy and science."[1002] Understanding, exploring, and celebrating the "essential interrelation" of democracy and science became a key to fighting the spread of both authoritarianism and irrationalism, which had swept through European countries. Despite the progress of science and the popularity of democratic ideals, humanity took a great step backward with the rise of fascism. Lindeman explained:

> Indeed, a new authoritarian movement, almost a coalition although not consciously organized, had arisen in our midst. Strange voices using masked words were heard throughout the land, voices demanding a new authority in education, in morals, and in government. These voices used the familiar words of the democratic tradition but the ideas were not of that tradition.[1003]

Overall, the authoritarians "asked for allegiance to fixed principles, inflexible rules of morality, and unquestioned acceptance of a supernatural interpretation of human

[1001] Ibid.
[1002] Eduard C. Lindeman, "Introduction," *The Scientific Spirit and Democratic Faith*, ed. Lindeman (New York: King's Crown Press, 1944), ix.
[1003] Ibid., ix.

experience."[1004] Lindeman then blamed intellectual elites "in positions of power and influence," religious fundamentalists who "found themselves again in ascendancy," and mass-media publications that profited from the spread of such nonsense.[1005] Central to the spread of fascism was the acceptance of these ideas by the masses. There were also "a few men and women of wealth, fearful of the future and embittered against all progressive tendencies… discovering solace among those whose face were turned toward the past."[1006]

Lindeman then asked: "How could such divergent groups find a common denominator, the sophisticates and the illiterates, rich and poor, the powerful and the defeated?"[1007] The answer is stated as follows: "They held in common their fear of the future, their anti-scientific preconceptions… their terrible need for certainty and security, and an identical logic."[1008]

Unlike the disparate groups that supported fascism, the contributors of this conference believed in the "dynamic power of science and truth."[1009] They celebrated a synthesis, which "combines science as a search for truth, democracy as the guarantee of liberty, humanism as the source of faith, and education as the instrument of progress."[1010] The last part of this statement cannot be overstated. The key battleground against fascism occurred in classrooms and educational books. It was not, in the minds of these intellectuals, an attempt to counter one dogma with another. The "scientific spirit" involved critical reasoning, the careful evaluation of evidence, and a solid

[1004] Ibid., ix.
[1005] Ibid., x.
[1006] Ibid.
[1007] Ibid.
[1008] Ibid.
[1009] Ibid. xi.
[1010] Ibid.

tradition of anti-authoritarian bravery. In the midst of "this troubled age," the interrelations of science and democracy became the most important American tradition in need of preservation.

On the one hand, the book is a call to arms for a scientist to "concern himself with matters of ethics and of politics."[1011] On the other hand, it was not enough for these scientists and intellectuals to assume prominent positions of power. They also had to communicate the "scientific spirit" through education and public enlightenment. Obviously, many of these sentiments stemmed from a much older discourse among scientists and academics. *In Science, Democracy, and American University: From the Civil War to the Cold War* (2012), historian Andrew Jewett analyzed this discourse in great detail.[1012] Jewett challenges traditional narratives by focusing on "a broadly political reading of the push to make America scientific." Long before the rise of technoscience or "big science," there was "a massive effort to mobilize science… as a resource for strengthening American democracy." Jewett has much to say about the changing views of the relationship between science, the state, and big business. Yet, a broader point is crucial: "In the post-Civil War United States, more than anywhere else, the advocates of a scientific culture felt obliged to actively reconcile the claims of scientific research with the requirement of democratic legitimacy." He added, "Never doubting that science and democracy would prove harmonious and even mutually reinforcing, they worked to transform European conceptions of science in keeping with American understandings of politics." Jewett's account also challenges long-standing

[1011] Henry Margenau, "II" in "The Democratic Responsibilities of Science," in Lindeman, 55.
[1012] Andrew Jewett, *Science, Democracy, and the American University: From Civil War to Cold War* (Cambridge: Cambridge University Press, 2012).

narratives surrounding the institutional retreat of scientists into disciplines, along with the rise of value-free objectivity. It is worth quoting Jewett in detail:

> Such an approach to the historical study of science and politics – what we might call the "disengagement thesis" – reflects a strong tendency among critical scholars since the 1960s to doubt that science can be a progressive force in society. Organization, administration, rationalization, bureaucracy, materialism: these are the social phenomena with which many commentators today habitually associate science. This critique, which echoes Max Weber's more radical interpreters, treats science as synonymous with an instrumental rationality that buttresses the rule of a dominant elite by claiming to offer only technical means to externally determined ends. The recent flourishing of critical theory, interpretivism, and poststructuralism has fueled an outpouring of critical histories of the human sciences, as dissident practitioners have joined with professional historians to rewrite each discipline's twentieth-century career as a story of defeat and alienation at the hands of professionalizers and value-neutralists.

One might state the case more directly: Decades of debates about professionalization and scientism reflect the attitudes of recent scholars, not the historical realities of the past. Jewett added, "the story of value-neutrality's ascent, however well told, is not a substitute for a full-fledged political history of scientific thought." It is time to document the historical realities, rather than advance a critique.

The activities of the science writers during the Second World War validate many of Jewett's points. In the perspective of many thinkers, not only did science offer "the basis for a cohesive and fulfilling modern culture," but also scientific thinking served as an antidote against the most unfulfilling, dangerous, and cultist aspects of medieval culture. Totalitarianism embodied the past and its horrors. The fascists and the communists were medieval in mentality. Democracy embodied the future, its wonders, and, most important, its freedom of thought.

Such a crusade for the present and future required disciples who were unafraid of a newspaper reporter or a microphone. It needed orators and writers to rush to the bully pulpit to spread and reinforce the social gospel of "scientific democracy." It

needed great communicators who could save souls from falsehoods, irrational beliefs, and cultist nonsense. Jewett compared these activities to a "missionary enterprise." Such language is incredibly appropriate.

Postwar Dreams

Willy Ley had spent most of the war earning a "precarious living" as an evangelist for the scientific spirit. He had worked hard to educate Americans, combat hysterical notions, and serve the war cause in his own way. He must have felt a degree of pride in his accomplishments as a science writer and technology expert. Whereas many New York publishers had promoted sensational and misleading books, Viking had acted responsibly. Whereas many newspapers and tabloids had profited from public fears and anxieties, Ley's *PM* articles sought to calm readers and bolster their faith in Allied technologies of war. Ley had debunked the nonsense and dethroned several of the phonies. In many ways, he had taught his readers to think scientifically about the dangers and realities of war.

By late 1944, the war was coming to an end. Ley had no intention of continuing his career mainly as a freelance writer, living on book royalties and small checks. As an American citizen, he could now work full-time. As a new father, he also needed a more reliable and stable income. As the public clamored for more information on Hitler's mysterious weapon, he left New York.[1013]

Destination: Atlanta. Finally, Willy would become an American rocket engineer, or so he hoped.

[1013] FBI Files, "Request for Investigation," January 13, 1951.

Chapter 6: An Engineer's Dreams

In late 1944, Willy Ley attempted to transition from science writing to rocket engineering. His motivations for the move are not documented, yet it seems likely that Ley perceived an opportune moment to position himself as America's rocket expert, capable of applying his expertise to an emerging field. Although he did not understand the technical details of the V-2 or the make-up of the personnel at Peenemünde, Ley must have realized that the time was ripe for American rocketry, following the revelation that one of Germany's secret weapons was the V-2.

At precisely the moment when journalists were scrambling for information about the new weapon, Ley joined the newly formed Burke Aircraft Corporation in Atlanta, Georgia.[1014] Very little is known about his work or the general plans of the petitioners for incorporation: Arthur J. Burke, H. Eliss, and H. Flynn.[1015] The company planned to "design, manufacture, and sell power plants for the operation of heavier-than-air craft" as well as "meteorological or 'coast guard' type life saving [sic] rockets, signal rockets and jet propelled, rocket type projectiles."

In the late spring of 1945, Ley publicly spoke about his meteorological rockets in a lecture for the Atlanta section of the American Society of Mechanical Engineers.[1016] Apparently, he had made much progress with a motor designed for a ten-foot rocket with a four-inch diameter. It would soar as nearly 2000 per second up to 85,000 feet, before parachuting down with instruments and data unharmed. Ley even

[1014] Public records indicate that Burke Aircraft Corporation was incorporated on June 13, 1944. It experienced involuntary dissolution on May 1, 1981. A ProQuest search for further information produced zero results.
[1015] This petition is available online at http://soskb.sos.state.ga.us/imaging/16414792.pdf.
[1016] See *The Breeze* 2:4, May 10, 1945. This article was discovered and posted online by NOAA.

speculated about the cost benefits of future mass production of meteorological rockets. He was optimistic about the future.

Yet, Burke quickly became a dead end for Ley. The move was a mistake. By June of 1945, Ley grew disgusted with both the climate and his employer. Ley tentatively resigned from Burke by airmail. He explained to Heinlein, "I'm in no mood for further nonsense, four months breach of contract is enough."[1017] Ley gave Burke a June 30th deadline. "If by that time," he explained, "finances are straightened out to satisfy me, I promised to make a new agreement." Ley planned to move back to New York City, where he would accept an offer to become an editor for *Mechanix Illustrated*. He looked forward to the move: "If things go bad… I have to go on here [in Atlanta]."

This statement inaugurated a long period of frustration with organizations, contracts, and tentative connections to branches of the U.S. military. For the next three years, Ley would act an aspiring engineer and expert who was in the dark and on the outside, desperately trying to convince officials and key actors that his knowledge could be utilized for scientific research. He gradually came to terms with enormous obstacles that prevented him from gaining an insider status. He also discovered that many of the Peenemünders had not been killed. In fact, the former Nazi engineers were now working for the U.S. military. Not only would Ley come to realize his disconnect from the centers of continued rocket research, but also he realized that his own livelihood as an American expert on rocketry depended upon a cordial relationship with the former servants of the Third Reich. Eventually, he embraced his role as an outsider, and he

[1017] Ley to Heinlein, June 21, 1945, HA, Box 220-1, "Personal Correspondence, 1943-1971," 1. Subsequent quotes in this paragraph are found in this letter.

reconciled his conflicting views of the ex-Peenemünders. He also came to terms with the military and political realities of the Cold War, which gave new life to rocket as a weapon of war.

This reconciliation, along with its corresponding realizations, can teach us much about the obstacles that prevented a media-savvy popularizer from gaining access to a world of military and scientific secrecy. Ley's commitment to popularization, as well as his conviction that rocketry was an international "science," stranded him on the outside of research and development. Nevertheless, he utilized his status as an outsider to popularize the cause, which effectively made him an expert in the public eye.

Early Hopes of an Aspiring Expert

Prior to the dropping of the atomic bombs on Hiroshima and Nagasaki, Ley searched for an escape from Burke Aircraft. He reached out to his friends who had connections with the U.S. military. Most directly, he courted Robert A. Heinlein's relations with Navy superiors. A series of rather cryptic letters between Ley and Heinlein present a partial account of what followed. In June, Ley traveled to New York where he took the "9:30" to attend a meeting, possibly arranged with the help of Heinlein. Ley described the event:

> I had a conference lasting about two hours, partly with your friend, partly with a specialist from the proper projectile section who was called over. In these two hours we talked the problem over from all angles, and it seems to me that I gave satisfactory answers and outlined satisfactory plans. Of necessity everybody was a bit tight-lipped, but we got along fine and unless I get a report to the contrary I'm going to think that the meeting was successful.[1018]

[1018] Ibid.

It is unclear if this meeting was related the events that followed. On July 4th, Willy and Olga drank champagne. They did not celebrate a return to New York City. Instead, the Leys planned to move to Washington, DC, where Ley would become an employee of the Washington Institute of Technology, after it absorbed Burke Aircraft. Although WIT specialized in radio technology and plastics, it hoped to get into the field of aeronautics. Ley would lead their efforts in meteorological rockets. He explained his job in these terms: "I am paid $500 a month for the purpose of carrying out the necessary groundtests [sic] for rocket motors which are to go into meteorological rockets."[1019] Whereas the Ley of earlier years saw meteorological rockets as the next logical step, the Ley of late 1945 argued, "I feel that meteorological rockets are slightly ridiculous after V-2… [but] they may be something of commercial value."[1020]

Ley explained how this merger came about in a previous letter to Heinlein. While he "recovered" from his New York trip, a "local banker" asked him to go to Washington.[1021] This man agreed to pay all of Ley's expenses. The banker indicated that his "friends… might take Burke Aircraft over, pending a discussion with me."[1022] It may have helped that Ley owned many shares of Burke, given to compensate him for unpaid work.

Ley recalled his pessimism surrounding the trip: "I went with great misgiving, calling myself an idiot for going to the trouble of a trip to Washington for nothing… well the result was a kind of temporary merger."[1023] The WIT agreed to assume "all responsibilities" for Burke Aircraft until January 31st, 1946. This was Ley's first

[1019] Ley to Heinlein, August 3, 1945, HA, Box 220-1, "Personal Correspondence, 1943-1971," 1.
[1020] Ibid.
[1021] Ley to Heinlein , July 4, 1945, HA, Box 220-1, "Personal Correspondence, 1943-1971," 1.
[1022] Ibid.
[1023] Ibid. All subsequent quotes in this paragraph are found on this page.

deadline to secure a governmental contract for meteorological rockets. If he failed to secure a contract, Burke and WIT would part ways. Ley was optimistic: "Naturally, this is a great step forwards, the WIT has extensive laboratories and facilities, they employ a complete staff of specialists in all kinds of fields… so the work should make rapid progress." He also looked forward to the job, adding, "My presence in Washington might also be useful in other respects."

Meanwhile, Heinlein continued to work behind-the-scenes to facilitate Ley's contact with Captain Cal Laning. Ley first spoke of his relationship with Laning in retrospective and disappointing terms: "My conversation with Captain Laning led me to expect that after the war I would be put in a position, financially I mean, to carry on the necessary experiment for a Moon Messenger."[1024] Ley continued: "I was given to understand that certain things would have to be kept secret since the Navy was interested in long distance rockets of the V-2 type and that it was naturally understood that any of my work which could be applied would be applied."[1025] Ley also summarized a previous meeting with one of Laning's subordinates, telling Heinlein that "the Lt. Com. I talked to (I forget his name) was so careful 'not to divulge any secrets' that I am at a complete loss to judge what is going on."[1026] Ley added:

> I know that I can keep a secret if I am told that it is one, the question is therefore very simply of whether they are going to trust me or not… As it stands, I am completely unable to judge anything for lack of information and I feel, therefore, that I should postpone any action until I have arrived in Washington and had an opportunity to talk to Capt. Laning in more than three disjointed snatches.[1027]

[1024] Ley to Heinlein, August 3, 1945, HA, Box 220-1, "Personal Correspondence, 1943-1971," 1.
[1025] Ibid.
[1026] Ibid.
[1027] Ibid., 2.

Ley moved to Washington in late September 1945. By October, Heinlein offered apologetic excuses for Laning's earlier treatment of Ley, arguing, "I hope you have seen Laning again and have gotten better acquainted… Cal was very much upset that he was required to keep so much from you."[1028] Ley was in the dark and on the outside.

Atomic Realities

In an earlier letter, Heinlein launched into a heartfelt critique of the need to internationalize "atomics" by "turning it over to the United Nations."[1029] One might get the impression that Heinlein was prodding Ley, after Ley's factual article on "Inside the Atom" appeared in the October issue of *Natural History*.[1030] Although the article did not express the same international sentiment, H. L. Shapiro of the American Museum of Natural History introduced it. Shapiro stated, "We cannot hope to remain the sole guardian of the scientific knowledge that has made the atomic bomb possible."[1031] Consequently, "it is the solemn obligation of scientists, particularly those concerned with human affairs, and of all men of vision, to work for a political and social organization of mankind that will, by making war impossible, permit us to employ our powers without disaster."[1032]

In a long letter, Ley responded to Heinlein on November 9th. First, he updated Heinlein on his relations with Laning: "Meanwhile Captain Laning came around twice… We are getting along beautifully… L. wants me to get together with some of his men, just as soon as restrictions have been lifted enough to enable them to talk

[1028] Heinlein to Ley, October 15, 1945, HA, Box: 220-1, "Personal Correspondence, 1943-1971, 1.
[1029] Ibid.
[1030] Willy Ley, "Inside the Atom" *Natural History*, October, 1945.
[1031] H. L. Shapiro, "Man and the Atom," *Natural History*, October 1945.
[1032] Ibid.

freely. Their pet fuel (hydrazine hydrat) [sic] it now turns out was used by the Nazis, in particular by Walther, for several rocket fighter planes which did not come off anymore."[1033] Ley then updated Heinlein on his progress at WIT: "By the time you get this letter my teststand will be fully assembled and tested and IF no leaking welding seams are found – I DON'T TRUST WELDING SEAMS !!! "[1034]

Ley then turned to the "awful question of atomic warfare."[1035] In a long and revealing passage, Ley agreed with Heinlein's internationalism after stating, "I am as worried about it as you are… and I cannot find a way out of the moral labyrinth."[1036] "So far," Ley continued, "Congress AND the senator from Missouri who is president (if only the real president were still alive) have done everything possible to make an atomic war certain."[1037] Ley then added his thoughts on the role of the scientist in the age of nuclear weapons:

> But the era has come where the world listens to the scientists… and the scientists have set up a concerted howl which I know to be non-organized, but which, in intensity, timing and unity of voice, outdoes any organizational effort of Dr. Goebbels of the past. The picture is not all black, there is still hope. Lots of hope, in fact, -- but I [would] like to see is an intellectual reason to count on survival, not just hope.[1038]

Ley concluded, "Yes, I agree in principle with complete internationalization of atomics and I also agree in principle with relinquishing sovereignty… I'd rather give up sovereignty then disperse, I am not too certain that I would enjoy life if there are no cities left."[1039] The last sentence of the letter contained a "frivolous thought" that can be

[1033] Ley to Heinlein, November 9, 1945, HA, Box 220-1, "Personal Correspondence, 1943-1971," 2.
[1034] Ibid., 2.
[1035] Ibid., 3.
[1036] Ibid.
[1037] Ibid.
[1038] Ibid.
[1039] Ibid., 4.

read as a permanent goodbye to Atlanta: "[W]e still would want to test dangerous atomic reactions… There is a perfect testing ground not far away: the six south-eastern states!"[1040]

Just as Ley cultivated a Navy contract, he voiced some of these sentiments in *Mechanix Illustrated*. His articles contained a fascinating mixture of hope, fear, and internationalism. For example, in an article called "Peace or Else!" he wrote: "Earth has become a world of Either/Or… Either—we are firmly determined that there shall be no war, and spend as much energy, thought and money on the problem of preventing it as we now spend in preparing for it… Or—we blunder into irretrievable errors."[1041] If the latter path is chosen, "Atomic war will come without warning and without declaration, with a fury so monstrous that the mind cannot conceive it."[1042] However, if humanity can enforce the former path of peace, "the future promises a period of incredible achievements, of unlimited progress, of infinite riches of knowledge and material riches, of immediate preliminaries to humanity's spread through the solar system as a first step to a spread through the galaxy."[1043]

Ley saw the situation in understandably dire terms, arguing that "every nation" will have nuclear weapons within five years.[1044] "The prevention of war," he wrote, "therefore, is not a scientific problem—it's a political problem."[1045] Scientifically, the

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[1040] Ibid. Regarding Germany, Ley advocated "a specific kind of surveillance" and "force of arms to keep the democratic Germans in power." "But don't shoot at German Nazis or similar breeds," he argued, "unless you mean to kill… shooting is merely what the German calls Theaterdonner (stage thunder) a word of which they are fond."
[1041] Willy Ley, "Peace or Else!" *Mechanix Illustrated*, February 1946, 45-46.
[1042] Ibid., 46.
[1043] Ibid.
[1044] Ibid.
[1045] Ibid.

destructive potential of atomic weapons was "so incredible that the mind rejects it."[1046] "The deaths of 100,000 Japanese in five microseconds," he argued, "was, therefore, *the gentlest possible application of the smallest possible atomic bomb*."[1047] Unlike previous wars, in which ground defenses could counter aerial bombardment, "science does not know any counter measure whatever against atomic explosives."

Suddenly, the war rocket had a utterly deadly and devastating use: "Couple V-2 and the atomic bomb (it can be done today) and you have a destroyer of cities against which there is no defense once the rocket is in the stratosphere." Whereas the earlier Ley stood baffled by the use of the V-2, he now took a less skeptical stance, stating, "It seems fairly certain now that V-2 was actually a part of the German atomic program; the rockets were finished in time, but the atomic bombs were not." Ley concluded the article by stating, "we need to realize that a new era in human relations is here, an era that no longer permits the concept of war which now means *complete, mutual,* atomic destruction. What we have to learn is to live with atomic energy!"[1048]

Rockets and Rumors

On December 17, 1945, Ley attended the Wright Brothers Lecture at the Chamber of Commerce in Washington, DC.[1049] Dr. Roxbee Cox of Powerjets shared information about British jet engines. The lecture was incredibly detailed. Ley recalled his reaction: "But the more the lecture progressed the more I began to feel a vague

[1046] Ibid., 47
[1047] Ibid., 72. All subsequent quotes from this article are found on page 72.
[1048] Other issues explored peaceful uses of atomic power. See, Willy Ley, "Atomic Engines for Peace," *Mechanix Illustrated*, March 1946, 44-47, 79; "Atomic Medicine," April 1946, 41-43, 153-154.
[1049] This account is presented in Willy Ley, "Improving Upon the V-2," *Astounding Science Fiction*, January 1947, 100-120.

yearning for simplicity. Several compression stages and several turbine stages, with six or eight combustion chambers twisted around each other began to look mildly frightening after a while."[1050] He added, "Slightly confused and somewhat bewildered and not at all capable of making up our minds about the things we had heard, we left… and walked over to F street."[1051] Slowly Ley approached a Navy exhibit that included a V-2 rocket, which he had only seen in photographs and newsreels. It was an emotional experience for Ley: "Meanwhile it had grown quite dark and a perfectly round moon rose in the East. It was purely an accident, but the big 46-foot rocket, lying sloping on the bridge section truck, raising its nose some seven or eight degrees, pointed directly to the rising moon. It looked 'target for tonight.'"[1052] A sudden emotion overtook Ley. He remembered: "One should be immune against sudden thoughts which spring up on such occasions; but… almost without any volition on my own part I said: 'Still in our lifetime.'" His excitement was then slightly dampened by observations of V-2's shoddy and rushed construction. A "certain carelessness of design was quite unmistakable."[1053] Ley displayed no awareness of the human misery that accompanied the underground production of the V-2 rocket.

Soon, Ley discovered a fact that was not known to the American public: Many of the former German rocket engineers had been "captured" by the United States Army. A War Department press release in October of 1945 had confirmed the transport of "certain outstanding German scientists and technicians."[1054] It is unknown how Ley

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[1050] Ibid., 100.
[1051] Ibid., 101.
[1052] Ibid.
[1053] Ibid., 103.
[1054] "Outstanding German Scientists Being Brought to U.S." War Department, Bureau of Public Relations, October 1, 1945, 1. Accessed 11/27/2013 (http://www.v2rocket.com/start/chapters/paperclip.gif).

learned that Peenemünders were among this group. This information contributed to his increasing frustration. On May 5, 1946, he received a letter from Col. Lanning, which read "Dear Willy, we aren't having much luck getting you into the Navy rocket picture."[1055] Two days later, Ley voiced his anger in a letter to Heinlein. "So far, unfortunately," he wrote, "nothing has worked out. I was supposed to translate German documents, -- no soap. I was supposed to interrogate the captured German rocket experts –- impossible. I am not invited anywhere for anything…" He added: "Apparently there is some higher-up bozo somewhere who does not want to deal with German-born citizens, but prefers to deal with genuine captured Nazis instead, presumably because they are, at least, not civilians."[1056] Ley went on to predict "a big disappointment… about White Sands."[1057]

The situation was not as bleak as Ley perceived. A week or so later, a "big session at the Navy Department" changed Ley's situation. He wrote quickly to Heinlein to recant his complaint, adding, "It seems that a big contract is coming up, big at least for a firm the size of W.I.T."[1058] Ley also gave this description of the scene: "What amused me a bit was that their r. experts, after listening to my exposition, just declared themselves fully satisfied and left the conference to attend to their own jobs, while our instrument man had to go through a long and exhausting discussion."[1059]

Under this arrangement, WIT would present a proposal and another conference would take place. If the Navy agreed, then WIT's "business manager will wrestle the

[1055] Ley to Heinlein, May 7, 1946, HA, Box 220-3, "Personal Correspondence, 1943-1971, 1.
[1056] Ibid.
[1057] Ibid., 2.
[1058] Ley to Heinlein, May 20, 1946, HA, Box 220-3, "Personal Correspondence, 1943-1971," 1.
[1059] Ibid.

contracting officer."[1060] A few weeks later, Ley still expressed his confidence, although he grew baffled by Navy bureaucracy. Yet, all signs pointed to a contract:

> Well, now I am sitting here waiting for the contract, there is some re-writing going on in the Navy Department and that re-writing (hold your breath) contains the provision that, a few months hence, the project is to be declassified… and that W.I.T. is THEN EXPECTED TO SEEK PUBLICITY for this project. Friends, brothers, colleagues and toverishtshi… I rejoice, my heart is happy, but I wish I could understand the Navy![1061]

By August, Ley's disgust with Navy bureaucracy returned. He told Heinlein, "Then, of course, there is our friend, the Navy. I am right now making estimates, crystal gazing at its worst and sometimes I feel like looking a reference up in Nostradamus."[1062] He continued: "The official request for a bid is in… and what they crammed into the specifications would have kept Peenemünde busy for a year."[1063] He also complained about the rising influence of Wernher von Braun, who did not endorse Ley for a contract. Ley recalled, "I saw Laning one night after his return from White Sands and told me about von Braun. When L. asked von Braun whether he knew me von B simply said 'yes' and fell silent. I wanted to know what would be done with him, but L. did not know."[1064] Ley added, "I only hope that the U.S. Army will not suddenly find him 'charming' in addition to being useful." He then complained about a recent announcement by the Army to launch a guided missile to the moon within 18 months. Ley asked, "Just who is writing science fiction these days?"[1065]

In September, Ley still felt optimistic. "The bid is in," he wrote, "my own reasoning seems to have official support, namely… don't take something that was

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[1060] Ibid.
[1061] Ley to Heinlein, June 6, 1946, HA, Box 220-03, "Personal Correspondence, 1943-1971," 1.
[1062] Ley to Heinlein, August 29, 1945, HA, Box 220-03, "Personal Correspondence, 1943-1971," 1.
[1063] Ibid.
[1064] Ibid.
[1065] Ibid.

developed for another purpose (long range artillery) just because it is bigger and try to go from there."[1066] The V-2 did not provide a blueprint for the future. It was a rocket of war. Ley stood poised to offer a rocket of peaceful, scientific exploration.

The Struggle against Nonsense

While Ley continued to doubt the potential of the V-2, articles began to appear in the press that argued otherwise. Most notable was G. Edward Pendray's "Next Step the Moon," which appeared in the September 1946 edition of *Collier's*. The article focused, in part, on the Army's announcement, while claiming: "Such a rocket would be only two or three times the size of the 14-ton German V-2 rockets of World War II."[1067] For Pendray, a moon shot with sophisticated instruments might be possible by 1952. This article was Pendray's third contribution to *Collier's*.[1068]

Throughout 1945 and 1946, Pendray had been gaining momentum in the press as a rocket expert. This momentum had begun as early as 1930.[1069] By 1945, Pendray cultivated the persona of a "Yankee Rocketeer" as a wild-eyed and goatee-sporting visionary.[1070] He published articles in *Coronet*, *Harper's*, *Collier's*, and other fairly

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[1066] Ley to Heinlein, September 16, 1946, HA, Box 220-3, "Personal Correspondence, 1943-1971," 2.
[1067] G. Edward Pendray, "Next Stop the Moon," *Collier's*, September 1946, reprinted in *The Coast Artillery Journal*, January/February 1947, 48-51.
[1068] See G. Edward Pendray, "The Rise of the Rocket," *Collier's*, January 22, 1944, 16-17, 44.
[1069] See G. Edward Pendray, "Will the Rocket Replace Artillery?" *Science and Invention*, November 1930, 600-601; "Rockets to the Moon," *Elks Magazine*, October 1931. This article is available in the Pendray Papers, Box 45, Folder: "October, 1931, Rockets to the Moon." See also, "What's in the Rocket?" *Scientific American*, July 1934, in Box 45, Folder: "Miscellaneous Publications, 1934." Pendray's most notable book during this period was *Men, Mirrors and Stars* (1935). For a general set of predictions about the future, see G. Edward Pendray, "The Crucible of Change," *The North American Review* 247:2 (Summer, 1939): 344-354. One of Pendray's first widely read articles appeared in the October 10, 1943 issue of *This Week*. See "Sky Rockets Grow Up," *This Week*, October 10, 1943, 4-5.
[1070] See, for example, "Yankee Rocketeer," *American Magazine*, March 1945, 129. For a richer discussion of Pendray's early activities, see chapter 8 of John Cheng's *Astounding Wonder*, 251-300.

popular magazines.[1071] For example, in 1945, *Popular Science* carried his "The Reaction Engine."[1072] It must have astonished Ley that the magazine introduced the article with these words:

> Popular Science Monthly feels both obligated and pleased to introduce you to rocket power. This authoritative article is the first attempt in any language to show the relation of the various kinds of rocket power now in use. It corrects widespread misconceptions, defines terms that everyone soon will be using, and discloses the amazing possibilities of locomotion without wheels.[1073]

Pendray's earlier claims most likely irked Ley to no end. For example, in 1943, Pendray hinted at secret governmental programs that made the rocket "one of the most successful weapons of modern warfare."[1074] Ley would have described that statement as complete and utter nonsense.

Much of Pendray's success followed the publication of his book, *The Coming Age of Rocket Power* (1945).[1075] The work lacked Ley's style of personal memoir, as well as his historical framework. Nevertheless, it succeeded in translating complex concepts for the general reader. Ley praised the book, saying, "Mr. G. Edward Pendray… has written a book on his favorite topic which will not only be interesting reading for the layman but may also serve well as an introduction to this field for engineers who were violently disinterested in rockets until V-2 came along."[1076] Nevertheless, Ley criticized Pendray for his many errors: "But while he proves himself a master of the broad stroke in painting this complicated picture, Mr. Pendray's

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[1071] Most notably, his "Tomorrow the Moon" may represent *Collier's* first venture in to space-related topics. See G. Edward Pendray, "Tomorrow the Moon," *Collier's*, September 9, 1945. See also, G. Edward Pendray, "Passenger Flights by Rockets," *Harper's*, March 1945, 353-358; "Age of Rocket Power," *Coronet*, March 1946, 149-161.
[1072] G. Edward Pendray, "The Reaction Engine," *Popular Science*, May 1945, 70-73.
[1073] Ibid., 70.
[1074] G. Edward Pendray, "Skyrockets Grow Up," *This Week*, October 10, 1943, 4-5.
[1075] G. Edward Pendray, *The Coming Age of Rocket Power* (New York: Harper & Brothers, 1945).
[1076] Willy Ley, "Review," *Military Affairs* 9 (Winter, 1945): 374.

attention to detail is not meticulous enough to make his book a reference work."[1077] Ley also claimed, "the book falls off in a sharp curve when it comes to predictions."[1078] On some matters, Pendray was "consistently pessimistic," yet, on other matters, he advanced a "curiously strained and forcefully optimistic discussion."[1079] Despite these flaws, "the value of the book as a 'first primer' is considerable."[1080]

Ley said nothing about *Harper's* promotion of the book, which labeled Pendray as "an outstanding world authority on rockets and jet propulsion…" However, a reviewer casually remarked, "As far as we are concerned… we can think of numerous other persons who could probably share our sentiments."[1081] Other reviewers were less kind to Pendray. Lionel S. Marks of *The Scientific Monthly* claimed, "The book is primarily a statement of what a rocketeer feels that the rocket will be able to do rather than an attempt to ascertain its foreseeable developments in the not-too-distant future…"[1082] Marks also stated that Pendray's attitude "is not one which could produce an analytical study, but is admirably suited to fantasy and speculation… The play of fantasy permeates most of the book."[1083]

Normally, Ley did not view his colleagues as competitors. He praised later books like Arthur C. Clarke's *The Exploration of Space* (1951).[1084] Ley applauded most works that furthered the cause of exciting the public to envision a future of rocket travel. Yet, with Pendray, the situation was different. Ley viewed Pendray's focus on

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[1077] Ibid., 375.
[1078] Ibid.
[1079] Ibid.
[1080] Ibid.
[1081] "Turns with a Bookworm," …*Tribune Weekly Book Review*, May 20, 1945. A clipping of this review is located in Pendray's files. Unfortunately, the clipping obscures the full title and page number.
[1082] Lionel S. Marks, "Jet Propulsion Theories," *The Scientific Monthly* 61 (September, 1945): 240.
[1083] Ibid., 240-241.
[1084] Arthur C. Clarke, *The Exploration of Space* (New York: Harper, 1951).

passenger rockets and earth-bound travel as detrimental to the cause of space travel. It is easy to imagine Ley scoffing at Pendray's statement: "For myself I do not know whether rocket power will ever permit fulfillment of our ambitious desire to reach the moon. Perhaps it isn't of very much moment, for in the age of rocket power jet propulsion will find plenty to do right here on earth."[1085] Ley commented on Pendray's pessimism, yet he did not comment on the book's agenda, which highlighted the contributions of Robert H. Goddard and the work of the American Rocket Society, while characterizing German developments as, according to one reviewer, "the Fritz Opel publicity-seeking variety."[1086] Ley may have viewed the book as a personal insult to Oberth, the VfR, and the engineers who designed the V-2.

The text also contained a few outlandish assertions. Pendray implied that the Germany rocketry fad began with publicity surrounding Goddard, particularly after Oberth "received a copy of Goddard's 1919 report directly from the author in late May or June of 1922."[1087] Pendray added, "By 1923—the year Oberth's book appeared in Europe—Goddard had reached the point of trying an actual shot with a liquid-fuel rocket." He then argued that Ley's books, along with the publicity surrounding *Frau im Mond* "meant very little" from an engineering point of view.[1088] "The Germans," Pendray wrote, "were too busy arguing the merits of space flight to do any actual experimenting… In the meantime, Goddard was going doggedly ahead, making and

[1085] G. Edward Pendray, "Age of Rocket Power," *Coronet*, March 1946, 159. This article is a condensed section of Pendray's *The Coming Age of Rocket Power*.
[1086] Rufus Oldenburger, "All about the Rockets: Layman's Book Tells Potentialities," *Chicago Sun Book Week*, June 3, 1945, page unknown. Clipping found in Pendray Papers.
[1087] G. Edward Pendray, "The Persistent Man," *Coast Artillery Journal* 91 (Jan.-Feb., 1948): 54. This article is extracted from Pendray's *The Coming Age of Rocket Power*. The appendix of Oberth's text indicates the truth of this claim, since he extensively quoted Goddard's figures. It is doubtful that those figures appeared in German newsprint.
[1088] Ibid., 54.

shooting rockets."[1089] In his obituary of Goddard, Pendray went further, stating that Goddard's research on "jet propulsion, particularly applied to high power rockets…was mainly responsible for the immense progress of the subject in the last three decades."[1090] Pendray even argued, "On March 16, 1926, he shot the first liquid fuel rocket ever constructed… which was the ancestor of all liquid fuel rockets constructed since, including, of course, the German V-2 rockets."[1091] Pendray was beginning to hint that the V-2 rockets had been influenced by Goddard's designs, as if the Germans had stolen the plans. Goddard himself believed this assertion.

Ley kept quiet about Pendray's motives, for the time being. However, in late 1946, he quickly revised and expanded his own book on rockets, now titled *Rockets and Space Travel* (1947).[1092] As he revised the text, he had yet to reunite with any of his former German colleagues. That situation soon changed.

A Tense Reunion

On Friday, December 6, Ley reunited with von Braun for an evening of wine and shoptalk in Ley's apartment.[1093] Ley welcomed von Braun, who expressed a great pleasure to see Ley after such a long absence. They enthusiastically discussed the German rocket program until 2:45 am. In a letter to his friend Herbert Schaeffer, Ley spoke of the tension in the room: "I intentionally took no notes during the conversation,

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[1089] Ibid.
[1090] G. Edward Pendray, "Robert H. Goddard," *Science*, November 23, 1945, 521-522.
[1091] Ibid., 522.
[1092] Viking released this enlarged and expanded edition in March of 1947, according to "Books Published Today," *NYT*, March 21, 1947.
[1093] On December 5th and 6th, Pendray oversaw the First National Convention Meeting of the American Rocket Society at the Hotel Pennsylvania in New York City. A program of this meeting can be found in the Pendray Papers, Box 12, Folder 6: "American Rocket Society, 1946, General and Corresp." There is no indication that Ley attended these events, most likely because of Pendray served as "toastmaster." Or, Ley may have had other obligations on Thursday.

so that it did not seem like an interrogation…"[1094] Yet, Ley memorized each point and then later recounted them to Olga. Both Ley and von Braun showed much caution with questions and answers, so that the meeting could not be "misunderstood" by governmental officials. Ley also informed Heinlein and Haviland of the meeting, which, in Ley's mind, was akin to informing the Navy directly. Haviland accompanied von Braun to the meeting.

Aside from learning as much as possible about the V-2, Ley learned other interesting facts.[1095] For example, a certain Col. Riffkin had read his *Rockets*. In fact, this official often quoted the book directly, and he expressed an interest in accompanying von Braun to New York. Ley was also surprised that von Braun knew something about his own work for WIT. Perhaps most noteworthy was Ley's judgment regarding von Braun as an engineer who worked for the Nazis: "I found no reason to regard v.B. as an outspoken anti-Nazi. But just as little, if not even less, did I find him to be a Nazi. In my opinion, the man simply wanted to build rockets. Period."[1096]

On the day that Ley reunited with von Braun, Col. Lanning wrote to Heinlein: "He [Ley] is going to have to play pretty hard to get into the rocket picture. For some time only the military will finance it, and will control the contractors. Yet Willy must be keep abreast. How will he do it I don't know."[1097] When Heinlein learned of Ley's meeting with von Braun, he expressed his revulsion, telling Laning, "I find the whole matter very distasteful, to say the least, but I can hardly raise too much Hell with Willy

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[1094] Willy Ley to Herbert Schaefer, WLC, Box 1, Folder 1: "Correspondence, 1945-1949."
[1095] It is possible that some of this discussion influenced Ley's March 1947 article, "Too Few, Too Late: Is the Story of Some of Germany's Guided Aerial Missiles, *Technology Review*, March 1947: 281-282, 304, 306.
[1096] Ibid., translation taken from Neufeld, *Von Braun*, 232.
[1097] Laning to Heinlein, December 6, 1946, HA, Box 017, Opus 052, "A Spaceship Navy aka Flight to the Future," 1.

over fraternizing with a Nazi when… he was urged to do so by a Lt.-Cmdr, who joined him in doing it."[1098] Laning responded by also defending Ley's actions. "I fear I can pardon him. This damned kowtowing to von Braun seems to have made it necessary for anyone, who wants to know the rocket field, to get information from that former Nazi. Willy has not had a very fair deal in this country as far as employment of his talents is concerned."[1099] In spite of this defense, Laning cautioned Heinlein by stating, "I'm sticking my neck out to vouch for him; if you have information please warn me."[1100] Later in the month, Heinlein told Laning: "I agree with your feelings about von Braun and Ley, both as to revulsion at the kowtowing to former Nazis by many and as to the fact that Ley is constrained unavoidably by expediency."[1101] Heinlein continued: "I have no reason at all to doubt Ley from a political standpoint, but this incident has reduced my opinion of his judgement [sic]… I am not willing… to sponsor him any longer."[1102] Ley's further attempts to secure a Navy contract would be futile.

Rockets and Space Travel (1947)

In February of 1947, Viking released Ley's revised and expanded edition of *Rockets*.[1103] In a new foreword, Ley explained the new title: "This is a book about rockets and about the idea of interplanetary travel, and I wish to emphasize that these two things belong together."[1104] He also stated, "Because it is my firm conviction that

[1098] Heinlein to Laning, January 12, 1947, HA, Box 017, Opus 052, 1.
[1099] Laning to Heinlein, January 24, 1947, HA, Box 017, Opus 052, 1.
[1100] Ibid.
[1101] Heinlein to Laning, January 28th, 1947, HA, Box 017, Opus 052, 1.
[1102] Ibid.
[1103] Willy Ley, *Rockets and Space Travel: The Future of Flight Beyond the Stratosphere* (New York: Viking, 1947).
[1104] Ibid., 1.

rocket research will lead to the realization of that great old dream and because I see little value in any rocket research which states that it is not supposed to lead to that goal, I have written this book."[1105] On the one hand, Ley still downplayed the future evolution of "war rockets," by arguing that space travel was the goal of rocket research. On the other hand, he removed the passage that claimed that the story of the war rocket "lies in the past."[1106] Instead, he presented the V-2 as "merely the beginning."[1107] Future rockets would rise higher. After that, "the spaceship will follow… one day in the future. Possibly in a future not too distant."[1108] He also removed a passage from chapter three that stated, ""The modern war rockets do not replace artillery in any way; they merely augment it."[1109]

Ley made several small revisions to the existing chapters. The organization of the book remained the same, apart from the inclusion of two new chapters called "The Rockets of the Second World War" and "Peenemünde!" Ley's narrative surrounding the V-2 is interesting and revealing. Mostly, it indicates what he did not know about the production and technical details of the V-2. Instead, the chapter can be read as an American science writer's catalogue of all known facts, often told from the perspective of the Allies.[1110] Ley did not evaluate the V-2 in kind terms, although he glorified the broader implications. The V-2 was "not fully developed" and "showed a number of glaring imperfections."[1111] He added, "A 'usable state' was good enough for the hard-

[1105] Ibid.
[1106] Ley, *Rockets* (1944), 4.
[1107] Ley, *Rockets* (1947), 2.
[1108] Ibid.
[1109] Ley, *Rockets* (1944), 78.
[1110] See, for example, Ley, *Rockets* (1947), 207.
[1111] Ibid.

pressed Germans."[1112] Nevertheless, the V-2, in spite of its failure to alter the course of the Second World War, "transformed the face of war for all time to come."[1113]

Ley's "knowledge of the people who worked at Peenemünde [and] the background of the V-2 project" became a key selling point.[1114] In retrospect, his knowledge in 1947 was minimal. However, there are a few passages that indicate last minute revisions of the text, possibly based on his December 6th, 1946 meeting with von Braun. For example, Ley told this story:

> During 1943 Count von Braun went to see Hitler at his headquarters at the eastern front. With him he had rolls of film, documenting the research work done. Apparently both von Braun (who happens to look like the picture of the 'perfect Aryan Nordic' invented by the Nazis) and his films impressed Hitler sufficiently to make him change his mind. He ordered mass production…[1115]

Otherwise, Ley relied more heavily on newspaper accounts than information from the ex-Peenemünders. Yet, his glorification of the rocket research center was the first step toward a more "sanitized history of Nazi rocket activities palatable to Western audiences during the Cold War."[1116] As Neufeld also argues, Ley knew little about the atrocities "due to a deliberate policy of silence by the ex-Peenemünders and the U.S. government."[1117] Inadvertently, he crafted a narrative that served their interests.

Other changes to the text indicate Ley's increasing focus on the application of atomic power to rocketry, as well as the use of rockets to deliver atomic warheads. Here, the text reflected an enormous change in Ley's evaluation of the V-2 and aerial weapons. In the past, he consistently told the public to "keep calm" due to the evolving

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[1112] Ibid.
[1113] Ibid.
[1114] "Rockets to the Moon," *Newsweek*, March 24, 1947, 64.
[1115] Ley, *Rockets* (1947), 221.
[1116] Neufeld, "Creating a Memory," 73.
[1117] Ibid., 72.

balance between offensive and defensive weaponry. Now, Ley could offer no valid counterargument to the "prophets of doom." Ley admitted, "But all these arguments pro and con are invalid now; they have been cut short by the atomic bomb."[1118] Although the V-2 remained an inaccurate missile, "it becomes the final weapon if it carries an atomic bomb… Four or five chance hits in the London area would leave a blob of molten masonry which only by its presence would indicate that it marks the site of a former city... there is no defense."[1119]

The revised text began to reflect the broader context of the Cold War. Although Ley mostly avoided discussing the military applications of space technologies, the implications of the text were obvious. In fact, science writer Martin Gardner reflected on the book in *The Scientific Monthly*. He wrote, "Now… it is evident that space travel is only a few years away and that the first nation to establish a military base on the moon will dominate the earth…"[1120] Ley encouraged this type of thinking with extremely optimistic accounts of the pay-offs for the first nation that constructed a space station: "The station in space promises many new discoveries. It is not impossible that a single one of them will pay for everything."[1121]

Some readers may have been disappointed by Ley's superficial account of the V-2, since he lacked insider knowledge. However, most reviewers praised the book, while reaffirming Ley's unique status as a foremost rocket expert. In fact, the *Field Artillery Journal* claimed, "This is *the* book on rockets and space travel."[1122] Gardner disagreed: "Ley's book should be read in conjunction with G. Edward Pendray's *The*

[1118] Ley, *Rockets* (1947)., 229.
[1119] Ibid.
[1120] Martin Gardner, "Through Pathless Realms," *The Scientific Monthly* 66 (January, 1948): 78.
[1121] Ley, *Rockets* (1947), 314.
[1122] Display Ad 220, *NYT*, May 25, 1947, BR31.

Coming Age of Rocket Power."[1123] During these months, one might suspect that Ley worked behind the scenes to rival Pendray. For example, after the *Coast Artillery Journal* printed a Pendray extract that focused on Goddard, Ley shot back. The March/April issue contained two original articles titled "The Problem of the Step Rocket" and "The Interception of Long-Range Rockets," as well as an extract from Ley's book. Ley also allowed the *CAJ* to reprint his "Limitations of the Long-Range Missile," which originally appeared in *Ordnance* magazine.[1124]

Meanwhile, Ley likely grew disturbed by the rising anti-German sentiment regarding the U.S. military's employment of the ex-Peenemünders. Neufeld described the broader scene in early 1947:

> The public unveiling of Project Paperclip provoked a backlash among left-wing scientists, liberals, and Jewish groups, all of who protested the employment of 'Nazi scientists,' as they were most typically labeled, on the grounds that they were morally and criminally compromised by their work for Hitler, carriers of race hatred and alien ideology, and/or mere engineers and technicians who were not real scientists.[1125]

Neufeld added, "A fair amount of prejudice, some of it crudely anti-German, was thus mixed up with some telling critiques of the amorality of the U.S. military hiring those who had so recently designed weapons to be used against Allied populations."[1126] This anti-German sentiment fit well with Pendray's efforts to nationalize the history of rockets by making it an American story. While critics wanted the German engineers expelled, Pendray wanted to expel the German "pioneers" from the historical record. This anti-German sentiment also threatened Ley's position. It may have led to awkward

[1123] Gardner, "Through Pathless Realms," 78.
[1124] See the *Coast Artillery Journal*, March/April 1948. The extract was titled "The Moon Rocket."
[1125] Neufeld, *Von Braun*, 235.
[1126] Ibid.

moments during public lectures, when audience members assumed that he had also "switched sides."[1127]

Although Ley would later defend this group publicly, he remained rather silent during 1947. He may have had mixed feelings. On the one hand, this was a time when his anti-Nazism hardened into a more virulent anticommunism. If he had known the true extent of von Braun's activities, as well as the use of concentration camp labor in the construction of the V-2 rockets, Ley might have severed his ties to these Germans. On the other hand, he viewed them as apolitical engineers, who were forced to work for the Nazis. This attitude surfaced later during a 1957 *Night Beat* interview with Mike Wallace. At the same time, Ley was now dependent upon these Germans for information about the V-2 program. His reputation, as well as the livelihood of his family, depended upon his success as a freelance writer and historian. The Peenemünders would become indispensable sources of information.

Technology Review

While Ley continued to contribute to *Mechanix Illustrated*, he became more directly involved with MIT's *Technology Review*. Not only would Ley serve as one of the publication's editorial associates, but he would also contribute a dozen articles on science and technology.[1128] In many ways, this move indicated Ley's ambitions to be associated with a more respectable publication, while he simultaneously worked as an

[1127] According to eldest daughter Sandra Ley, a disabled man in a wheelchair often interrupted his New York lectures by yelling, "Willy Ley is a Nazi!"
[1128] Topics included "Space Station," February 1946; "The Channel Tunnel" March 1946; "Rockets in Battle," December 1946; "Too Few, Too Late Is the Story of Germany's Guided Aerial Missile," March 1947; "Some Angles on Trisection," May 1948; "Take a Number," February, 1949; "Glaskogels," April 1949.

engineer.[1129] Indeed, MIT's *Technology Review* was a "who's who" of influential scientists and science writers. For example, Ley shared staff responsibilities with the president of MIT, James R. Killian, Jr., along with Philip M. Morse, who is considered the "father" of operations research. Often, Ley's articles appeared alongside influential writers. For example, the January 1946 issue showcased Ley's "Fortunes—Twenty Fathoms Down" alongside "Research on Minority Problems" by psychologist Kurt Lewin and "Science and the Civil War" by I. Bernard Cohen, who became the later editor of *Isis*.[1130] Other contributors included anthropologist and science writer M. F. Ashley Montagu, engineer Harold E. Edgerton, and mathematician and science writer Paul Cohen.[1131]

Science administrator Vannevar Bush contributed frequently. Indeed, some of Bush's articles outlined the overall agenda and cause of *Technology Review*. Ley must have appreciated this broader agenda. For example, in "Science, Strength, and Stability," Bush argued, "In coming of age as a profession, science imposes new duties on scientists and engineers in the problem of attaining national harmony and international peace."[1132] It was not enough to simply have faith in science, because "faith without work is not enough… there is work, much and great work, to be

[1129] Ley continued to contribute to science fiction pulps, albeit less frequently in the late 1940s. For *Astounding Science Fiction*, see Willy Ley, "Improving Upon the V-2," January 1947, 99-119; "Pseudoscience in Naziland," May 1947, 90-98; "Push for Pushbutton Warfare," September 1947, 87-104; "The Other End of the Trajectory," July 1948, 63-72; "The Brickwall in the Sky," November 1948, 79-99; "Science and 'Truth,'" December 1949, 95-111. For *Startling Stories*, Ley also wrote parts 1, 2, and 3 of "The Road to Space Travel," March, July, and September 1949; See also, "Medicine and Space Travel," September 1949.
[1130] See *Technology Review*, January 1946.
[1131] See, for example, M. F. Ashley Montagu, "The American Family," *Technology Review*, March 1946; Harold E. Edgerton, "Night Aerial Photography," March 1947.
[1132] Vannevar Bush, "Science, Strength, and Stability," *Technology Review*, July 1946, 553.

done."[1133] This endeavor to ensure world peace, international cooperation, and universal prosperity rested upon the shoulders of scientists and engineers, who had an "ethical imperative." Bush outlined "two great ends." The first goal included "how and why we can best share in the forming of the sound public opinion essential to strength and stability."[1134] This task was essential in a democracy, where public opinion became the driving force for governmental decisions. The second task simply extended the reach toward "the formation of the enlightened world opinion which must be developed for peace among nations to be assured."[1135] Scientific truths were international truths. Therefore, all scientists spoke a common language in their "ministry to the people."[1136] By broadcasting their message, they would spread the gospel.

In a later article, Bush expanded on "the scientific way," as well as the role of the scientist and engineer, each guided by reason as the stepping-stone toward truth. In his view, "The follower of the scientific way… knows when he has come on a new thing, vigorously exercises reason thereafter, to define the new fact, to limit it, and to distinguish and explain its similarities and dissimilarities to older known facts."[1137] In this endeavor, the scientific mind could "relate the new thing to the whole body of knowledge, finding where it belongs and what its bearing is on the whole and on the several parts of the whole."[1138] As such, "He contributes to the ultimate formation of answers to other problems which have not yet been brought to solution, and so increases the homogeneity of knowledge as a whole."[1139] There is pure joy in fulfilling the

[1133] Ibid., 553.
[1134] Ibid., 588.
[1135] Ibid.
[1136] Ibid.
[1137] Vannevar Bush, "The Scientific Way," *Technology Review*, June 1947, 464.
[1138] Ibid.
[1139] Ibid.

"conditions" of being an interdisciplinary and holistic scientist. "The essential condition," Bush wrote, "is an intense, innate conviction that knowledge is good, that knowing is good, and that therefore to increase knowledge by conscious willed exertion of the intelligence is both duty and high privilege."[1140] He added: "To follow the scientific way is thus a profession of the faith that, as we know the truth, the truth will make us free."[1141]

Cohesively, the journal glorified American ingenuity and the utopian potentials of science and technology. For example, *Technology Review* published a speech by J. Robert Oppenheimer, which argued, "Of all intellectual activity, science alone has… turned out to have the kind of universality among men which the times require."[1142] This universality could be seen most directly in the West, whereas science was in a general state of "decay" in Soviet zones. Oppenheimer argued, "Yet in those areas of the world where science has not merely been disturbed or arrested by war and by terror, but where terror and its official philosophy have, in a deep sense, corrupted its very foundation, even the traditional fraternity of scientists has not proved adequate protection against decay."[1143] Still, Oppenheimer was generally optimistic about the future: ""The great testimony of history shows how often in fact the development of science has emerged in response to technological and economic needs, and how in the economy of social effort, science… pays for itself again and again in providing the

[1140] Ibid., 484.
[1141] Ibid.
[1142] J. Robert Oppenheimer, "Physics in the Contemporary World," *Technology Review*, February 1948, 231.
[1143] Ibid., 202.

basis for radically new technological developments."[1144] Rather than pondering on the likelihood of atomic destruction, Oppenheimer added:

> As long as there is a healthy physics… there will come in the future… things which will improve man's health, ease his labor… divert and edify him… shorten his working day and take away the most burdensome part of his effort, which will enable him to communicate, to travel, and to have a wider choice both in the general question of how he is to spend his life, and in the specific question of how he is to spend an hour of his leisure.[1145]

Other writers focused on the potential of science and technology to bring international peace. Robert T. Haslam outlined the general tone of this sentiment: "Peace must be waged. It must be built. It must be created out of some very difficult and uncertain material. We must organize for it, work for it, fight for it."[1146] M. F. Ashley Montagu argued that atomic energy, if "freed from the menace of war… can be, for all of us, in all nations, the great cohesive force which makes one world possible."[1147] Montagu advocated "a philosophy which creates the consciousness of a common purpose in mankind, which at once establishes the principle of the right to cultural self-determination and the international cooperation of all mankind."[1148]

Other key articles included pleas for scientific education as a means to train citizens to think scientifically in a democratic context. In particular, the magazine published James R. Killian, Jr.'s valedictory address, which argued, "tolerance, willingness to accept change, and faith in the future and in our spiritual unity stand as bulwarks against doctrines of regimentation."[1149] Against the threat of communism stood "knowledge about our American democracy and its special ideals and values."

[1144] Ibid. 203.
[1145] Ibid.
[1146] Robert T. Haslam, "World Energy and World Peace," *Technology Review*, July 1948, 493.
[1147] M. F. Ashley Montagu, "Atom-Bomb World," *Technology Review*, February 1950, 230.
[1148] Ibid.
[1149] James R. Killian, Jr., "Our Shared Convictions" *Technology Review*, July 1950, 503.

This knowledge was "the strongest weapon" against "the zealot."[1150] The speech went on to identify key common denominators that united Americans against the totalitarian other. These denominators included "a deep-seated faith in the future," "a belief in the validity of change," "a tolerance of differences, a repugnance for regimentation, and an acceptance of dissent," as well as "the spiritual unity of our people."[1151] The speech concluded with a dire warning: "As you take your place as active, producing, creative citizens of America, you have a mandate, as educated men and women… to live the American credo if you want the American credo to live."[1152]

A different article by physicist Arthur Compton demanded "Education for Peace."[1153] He argued: "If this democratic society is to compete successfully with dictatorial civilization, it must likewise develop leaders of outstanding professional competence, dedicated to honorable action in the interest of human welfare."[1154] It was equally essential to train ordinary Americans: "We are beginning to realize that our strength lies in the many millions of our citizens who are working efficiently and loyally at the nation's tasks."[1155]

The speech blended well with other articles in *Technology Review*. Most notably, Joseph H. Keenan's "Education for Freedom" stressed the mandate of education as the foundation of American democracy.[1156] He wrote, "The requirement for self-government among men appears to be a fairly high degree of development of

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[1150] Ibid.
[1151] Ibid., 504.
[1152] Ibid. 550.
[1153] Arthur H. Compton, "Education for Peace," *Technology Review*, July 1948, 501-503, 530, 532.
[1154] Ibid.
[1155] Ibid., 502-503.
[1156] Josheph H. Keenan, "Education for Freedom," *Technology Review*, February 1951, 195, 220, 222. See also H.B. Phillips, "What is Democracy?" *Technology Review*, June 1948, 433-434, 456, 458, 460.

the intellectual and moral potentialities of the individual."[1157] Therefore, "nothing less than a wide dissemination and a general acceptance of the principles of free inquiry and of individual responsibility will do."[1158] Like other scientific democrats, he argued, "It is not an accident that science and democracy grew up together."[1159] He continued, "Science has provided us with intellectual integrity and objectivity – humility before the fact." Science also emphasized the importance of clear definitions, logical methods, and experiments. "In its broadest sense," Keenan wrote, "the scientific method is free inquiry itself."[1160]

Keenan further argued that the role of educator was not simply to disseminate information to students who absorbed the correct facts. The instructor could not be a dogmatic authoritarian who expected students or the general public to blindly accept truths. Instead, the educator must "exemplify the spirit of free inquiry and the sense of responsibility."[1161] He must inspire the student to engage in the same type of intellectual freedom. He must foster the "fullest possible intellectual development of the individual."[1162] He must infect them with his scientific spirit of free inquiry. Keenan concluded with a long passage from John Dewey's *Philosophy of Science and Freedom* (1950). Earlier scientists had advanced this type of rhetoric. For example, Oppenheimer argued, "The true responsibility of a scientist, as we all know, is to the integrity and vigor of his science. And because most scientists, like all men of learning, tend in part

[1157] Keenan, "Education for Freedom," 195.
[1158] Ibid.
[1159] Ibid.
[1160] Ibid.
[1161] Ibid., 200.
[1162] Ibid., 222.

also to be teachers, they have a responsibility for the communication of the truths they have found."[1163]

This duty and obligation was particularly necessary given the context of the Cold War. The broader mission of MIT fit well with liberal rhetoric. For example, in "President Killian's Statement of Academic Freedom and Communism," Killian argued: "The Institution is unequivocally opposed to Communism; it is also sternly opposed to the Communistic method of dictating to scholars the opinions they must have and the doctrines they must teach."[1164] On the one hand, MIT's researchers "must be free to inquire, to challenge… to doubt… to examine controversial manners, to reach conclusions of their own, to criticize and be criticized."[1165] He added, "Only through such unqualified freedom of thought and investigation can an educational institution, especially one dealing with science, perform its function of seeking truth."[1166] On the other hand, a line could never be crossed. "The teacher, as a teacher," he argued, 'must be free of doctrinaire control originating outside of his own mind. He must be free to be critical and objective in his own way, and above all he must work in the clear daylight without hidden allegiances or obligations which require him to distort his research or teaching in accord with dictates from without."[1167] If a teacher "were found to be subject to improper outside control in his teaching, the Institute would regard him as incompetent."[1168]

[1163] Oppenheimer, "Physics," 204.
[1164] James Killian, Jr., "Academic Freedom and Communism," *Technology Review,* May 1949, 432.
[1165] Ibid.
[1166] Ibid.
[1167] Ibid.
[1168] Ibid.

Outside of the pages of *Technology Review*, Vannevar Bush took this anti-communism further in his widely read book *Modern Arms and Free Men* (1949). In many ways, the text is a political document of the Cold War, because it illustrates how these views on science transitioned into critiques of the communist alternative. Bush argued, "The weakness of the Communist state resides in its rigidity to the fact that it cannot tolerate heresy, and in the fact that it cannot allow its iron curtain to be fully penetrated. All these things, vital to totalitarianism whether right or left, are fatal to true progress in fundamental science."[1169] Bush added: "Dictatorship can tolerate no real independence of thought and expression. Its control depends entirely upon expressed adherence by all to a rigid formula, the party line."[1170] Conway Zirkle made similar points in his 1949 book, *The Death of a Science in Russia*.[1171] Karl Sax, upon reviewing the book, remarked, "History proves that science cannot thrive under totalitarian control of any kind. Not since 1633… has science been so threatened by authoritarian control of the human mind."[1172]

A scientific democracy could never tolerate the authoritarian's "prejudiced and stereotyped thinking," along with their "rigidity," "narrow-mindedness," and "intolerance of ambiguity."[1173] Instead, it became crucial to purge the "irrationalism" and correct the authoritarian's "distortions of reality."[1174] Science, in turn, could operate

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[1169] Vannevar Bush, *Modern Arms and Free Men*, (New York: Simon and Schuster, 1949), 200.
[1170] Ibid., 201.
[1171] Conway Zirkle, *The Death of a Science in Russia* (Philadelphia: University of Pennsylvania Press, 1949). See also, *Soviet Science*, ed. Ruth G. Christman (Washington: for the American Association for the Advancement of Science, 1952); David Joravsky, "Soviet Views on the History of Science," *Isis* 48 (March, 1955): 3-13.
[1172] Karl Sax, "Review: Conway Zirkle, *The Death of a Science in Russia*," in *Isis* 4 (July, 1950): 238.
[1173] Ibid., 227. Here Cohen-Cole is referencing Theodor W. Adorno et al., *The Authoritarian Personality* (New York: Harper, 1950).
[1174] Ibid., 228.

as "a sort of mental hygiene," according to sociologist George A. Lundberg.[1175] It would provide a "unified method of attack… of modern natural science applied fully to human society, including man's thoughts, feelings, and 'spiritual' characteristics."[1176] Eventually, it would triumph over "magical thinking" and "prescientific modes of thought." [1177] "All that needs to be deplored," Lundberg added, "is the [layman's] inability to distinguish between fact and fable, the practical and the fantastic."[1178] If he embraced the truth, then the educated layman would realize: "When we give our undivided faith to science, we shall possess a faith more worthy of allegiance than many we vainly have followed in the past, and we shall also accelerate the translation of our faith into actuality."[1179]

In some cases, scientific intellectuals continued to view the history of science as a convenient weapon in this struggle to uplift the masses and cleanse the world of dogma. Most famously, this crusade is outlined in James Conant's 1946 lectures, published as *On Understanding Science*.[1180] Conant praised the scientists, yet held special praise for the public, which could embrace scientific thinking. For Conant, historical case studies could teach non-scientists how to see through the eyes of a scientist. Thus, the history of science became a key means to educate the masses and

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[1175] George A. Lundberg, *Can Science Save Us?* (New York, London, and Toronto: Longmans, Green and Co., 1947), 2. It should be noted that Lundberg disagreed with some of his colleagues' Cold War rhetoric. For example, he doubted that "science can flourish only in freedom." "The historical fact is," he argued, "that science has gone forward under a great variety of forms of government, and conversely, at other times, has been suppressed and frustrated by each of the same type, including democracy. See Lundberg, 45-46.
[1176] Ibid., 13.
[1177] Ibid., 4-5.
[1178] Ibid., 11.
[1179] Ibid., 115.
[1180] James B. Conant, *On Understanding Science: An Historical Approach* (New Haven, Conn.: Yale University Press, 1947. See also, Conant, *Science and Common Sense* (New Haven: Yale University Press, 1951). Many of Conant's points were later advanced by Bentley Glass' *The Timely and the Timeless: the Interrelationships of Science, Education, and Society* (New York: Basic Books, 1970).

debunk irrational beliefs. The lessons of the past would help to create "a unified, coherent culture suitable for our American democracy in this new age of machines and experts."[1181] In this sense, using the history of science to train citizens was akin to using military history to train soldiers.[1182] Chemical engineer Thomas S. Sherwood likewise argued, "A double purpose of our educational system might well be to acquaint the citizen with the true meaning of science, while broadening the training of scientists and engineers in the humanities.[1183]

Although Willy Ley's contributions to this scene were mostly apolitical histories of technology and science, he fulfilled Bush's hopes that the history of science and technology "are of profound worth in this search" for the truth.[1184] "The past," Ley wrote, "proclaims the future."[1185] He also sought to unite science and the humanities by writing popular histories of science.

Another Excursion into Romantic Zoology

When Professor Charles-Edward A. Winslow spoke at "Alumni Day 1948," he had this advice for his friends, colleagues, and the leaders of MIT:

> This history of living things… teaches something more inspiring than what we are often inclined to take with us from the teachings of the physical sciences. The physical sciences teach us that the world is gradually running down; that we are ultimately headed for a universe in which all is lifeless and static. But the biologist has a more inspiring story to relate… There is something extraordinarily encouraging and interesting in these facts of biology. Whatever

[1181] Conant, *On Understanding Science*, 19.
[1182] Ibid., 31.
[1183] Thomas S. Sherwood, "Science in Education," *Technology Review*, December 1948, 93.
[1184] In *Technology Review*, see also, Willy Ley, "The Delayed Invention," February 1950, 207-210, 230; "The Unchangeable Ship," January 1951, 147-149, 174. For a two-part history of the search for "the great unknown Southland," see "The Great Dream," April-May 1951.
[1185] Willy Ley, "War Rockets," *Technology Review*, December 1946, 95.

> happens, there is something worthwhile going on in the constant struggle and development of more interacting and interlocking agencies.[1186]

Ley shared Winslow's excitement for the history of living things. He loved to explore the mysteries, untangle the facts, and recall the past adventures of botanists, zoologists, and biologists. He also enjoyed sharing this sense of exploration, by writing educational and entertaining articles for magazines. For example, a September 1948 issue of *Natural History* contained a long article called "The Two-Thumbed 'Teddy Bear'," which was an in-depth exploration of the habits and history of koala bears.[1187] The article was also a detective story, particularly when it dealt with mysterious deaths of Koalas in captivity. When researchers solved the mystery, the results amazed. Not only did Koalas survive for millions of years by eating only the leaves of a eucalyptus tree, but also they survived by consuming only mature leaves. They had died in captivity when zookeepers fed them fresh leaves. Additionally, Ley communicated his sense of amazement at the mating rituals of Koala "harems," and the parenting habits of a Koala mother, who spanked her young one "until *she* found the punishment sufficient."[1188] Ley wrote similar detective stories about "The Story of the Fish Anguilla" in the February 1949 issue of *Natural History*.[1189]

In these articles, Ley excited readers. For example in a 1949 article for *Mechanix Illustrated*, Ley asked, "Do Prehistoric Monsters Still Exist?"[1190] The first line of the article stated, "Dinosaurs may roam the unexplored jungles of Africa!" Ley then discussed the long history of strange reports that have yet to be verified by

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[1186] "Alumni Day – 1948," *Technology Review*, July 1948, 507.
[1187] Willy Ley, "The Two-Thumbed 'Teddy Bear'," *Natural History*, September 1948, 328-332.
[1188] Ibid., 330.
[1189] Willy Ley, "The Story of the Fish Anguilla," *Natural History*, February 1949, 82-85, 93; "The Story of the Milu," October 1949, 373-377.
[1190] Willy Ley, "Do Prehistoric Monsters Still Exist?" *Mechanix Illustrated*, February 1949, 79-83, 140-144.

scientists. “They have not been officially described and not yet pinned down with a Latin label,” he argued, “But in all corners of the earth there are people who will swear to what they have seen.”[1191] He added, “Tales of natives and explorers cannot be discounted.”[1192] Any rational person may justifiably “wonder if we have fully explored the fringes of our animal world.”[1193]

Ley further explored the fringes in a revised edition of *Lungfish,* now titled *The Lungfish, the Dodo, and the Unicorn* (1948). [1194] The themes of this book should be familiar to readers of previous chapters. Ley’s additional chapters and slight revisions contained identical themes. What is noteworthy about the new edition can be seen in its public reception. Whereas the first edition had largely failed to attract a broader audience, the 1948 edition generated sales and publicity. Vincent Starrett of the *Chicago Daily Tribune* called it “one of the most fascinating books of our time.”[1195] A different reviewer described that book as “an astonishing zoological garden.”[1196] It also showed how “truth, as everybody knows, is sometimes stranger than fiction.”[1197] Consequently, this “most enchanting of recent books, an excursion into romantic zoology… [was] irresistibly readable from the first page to the last.”[1198] Orville Prescott of the *New York Times* praised the book’s “Wundersucht, which is a craving for the

[1191] Ibid., 82.
[1192] Ibid.
[1193] Ibid., 144.
[1194] Willy Ley, *The Lungfish, the Dodo, and the Unicorn* (New York: Viking Press, 1948). An excerpt was published in *Science Digest*. See Ley, “As Dead as the Dodo,” *Science Digest*, December 1948, 21-24.
[1195] Vincent Starrett, “Books Alive,” *CDT*, November 21, 1948, G4. See also, Fritz R. Leiber, Jr., “Some Strange Animals—Real And Faked,” *CDT*, October 31, 1948, E9.
[1196] “A Line O’ Type or Two,” *CDT*, April 6, 1949, 24.
[1197] Ibid.
[1198] Ibid.

miraculous."[1199] He wrote: "Zoology need not concern itself only with the dull and messy anatomy of dead and pickled animals; it can also investigate true and astonishing creatures and even mythical and enchanting ones." Prescott added, "Mr. Ley writes with scholarly precision, but with an amateur's enthusiasm. He delights to delve into obscure and ancient books… His relish in the curious freaks of evolution is great and his interest in 'undiscovered' animals that have been seen by hundreds of people but not by scientists is lively."[1200] Overall, "it is an unusually able and interesting example of popularization of science."[1201]

W. M. Mann of the National Zoological Park in Washington, DC also praised the book for both its scholarly and entertainment value. He wrote, "Willy Ley outlines the literature of natural history… [and] he has gone through an enormous amount of classical and medieval writing, and assembled his clues with as much suspense and thrill as would the writer of a modern 'who-dun-it.'"[1202] Although the text contained "one or two minor inaccuracies," the book as a whole was "so delightful and well done."[1203] Other science writers and historians agreed. In the pages of *Isis*, geneticist-turned-historian Conway Zirkle complimented the book: "Mr. Ley has written a book which is well unified. Perhaps the basic moral to be drawn is that nature can equal art even when art is most imaginative, and that science can match legend in romantic interest."[1204] None other than *Isis* founder and Harvard historian of science George Sarton praised the book. While nursing a "nasty cold" in 1951, he read Ley's *Lungfish*.

[1199] Orville Prescott, "Books of the Times," *NYT*, December 29, 1948, 19.
[1200] Ibid.
[1201] Ibid.
[1202] W. H. Mann, "Fancy and Fact," *Scientific Monthly* 68 (May, 1949): 358.
[1203] Ibid., 359
[1204] Conway Zirkle, "Review," *Isis* 40 (August, 1949): 290.

He then wrote a personal letter to Ley, saying, 'I… enjoyed it so much that I feel moved to express my thanks." Sarton also shared his own knowledge of the legends and myths surrounding living dinosaurs in Central Africa. The letter ended with the words, "Bravo! And best wishes to you."[1205]

Arguably, Ley's 1948 edition of *Lungfish* was his most popular success to date in the history of science. It explored the mysteries of Nature. It glorified the unknown. It celebrated the brave explorers and their daring adventurers. Overall, it taught readers how to see the world through the eyes of the explorer. Readers could embrace scientific thinking, without losing an iota of thrill, wonder, and enchantment. Ley was training his audience to embrace the scientific way, without discounting the wondrous aspects.

An Engineer's Dream

By October 1948, Burke Aircraft Corporation's absorption into the WIT was terminated. A contract between the Navy and WIT never materialized. By the spring of 1949, Ley no longer had a position as a research engineer. His contract with WIT officially expired on March 1st.[1206] His brief tenure as a consultant for the Department of Commerce soon ended.

His cumulative experience as research engineer involved a game of endless negotiation, contract bids, and fights with machinists. Most likely, the situation grew worse following the budget cutbacks of 1947, as well as the slow developments and departmental competition that frustrated von Braun.[1207] In general, Ley felt discouraged by the lack of progress. Apparently, his books, and the combined efforts of other

[1205] George Sarton to Willy Ley, March 3, 1951. WLC, Box 1, folder 5.
[1206] Biographical draft in PP, Box 12, Folder 18.
[1207] See Neufeld, *Von Braun*, 238-239.

science writers, had produced very few results. As von Braun attempted to generate publicity and even tried his hand at science fiction, Ley brainstormed further. Throughout much of 1949, Ley wrote fewer articles on rockets and spaceflight. There are some exceptions, such as his piece for *The Rotarian* called, "Want a Trip to the Moon?"[1208]

The Leys moved from Washington, DC to Montvale, New Jersey, where they lived in the house of Olga's mother, Dr. Maria Feldmann. According to Ley, it was a "beautiful and large house on a hill, near a forest…"[1209] Ley would spend two years in this rural setting, somewhat isolated from comfortable luxuries and public transportation of a big city, which Ley preferred. In this "frightfully idyllic and equally boring" setting, he wrote a best-seller.[1210]

The Conquest of Space

In September of 1949, Viking Press published *The Conquest of Space*, a coffee-table book with text by Ley and illustrations by Hollywood artist Chesley Bonestell.[1211] Many cultural historians of spaceflight, particularly Howard McCurdy, regard the publication as a watershed moment. Indeed, it was Ley's second-most popular book. With the exception of his many editions of *Rockets*, *Conquest* was Ley's bestseller. By 1950, the book achieved its 4th printing, before reaching an international market, from

[1208] See Willy Ley, "Want a Trip to the Moon?" *The Rotarian*, April 1949, 13, 51-54. In this article, he argued, "No flights are yet scheduled… but once science finds the right spaceship fuel—WHOOSH!" Ley then wrote: "The problem is merely one of lifting… It is this fact that makes a trip to the moon now merely as fantastic as a transatlantic flight seemed 20 years ago."
[1209] Ley to Heinlein, July 26, 1948, HA, Box 220-04, "Personal Correspondence, 1943-1971."
[1210] Ibid. This was a time when von Braun began to embrace publicity and even science fiction as a means of exciting the broader public.
[1211] Willy Ley, *The Conquest of Space* (with illustrations by Chesley Bonestell) (New York: Viking Press, 1949).

Italy to Japan.[1212] That international audience soon expanded due to Dutch, Finnish, German, French, Swedish and Spanish editions.[1213]

It is easy to see why the book was successful. Historians have rightly pointed to the beautiful paintings by Bonestell, which depicted the earth from space while giving readers a close-up view of the moon, Mars, and even the distant planets of our solar system. McCurdy is right to showcase the paintings as the book's "most distinguishing features," while Bonestell's name received top billing on the title page.[1214] The images were remarkable, not only for their scientific accuracy, but also for their imaginative insight. What is most remarkable (and often not commented on) is how many of Bonestell's illustrations resembled black and white photographs, meant to represent the first images of a trip from the earth to the moon. Bonestell painted them in color, but the black and white prints had a more dramatic effect. Not only are readers are given a first person glimpse of the journey to the moon, but also they are presented with images that represented the first transmissions from spacecraft. Bonestell's work was not simply an "artist's conception," according to Ley. Instead, they are "the product of a poetical mathematician with a paint brush."[1215] Each image served as "a picture which you might obtain if it were possible to get a very good camera with perfectly color-true film

[1212] See Willy Ley, *La conqista dello spazio*, translated by Anna Garino Aberti (Milano: Bompiani, 1950); See also *Yu zou de zhen fu* (Tokyo: Hakuyosha, 1950).
[1213] *Avaruuden valloitus*, suomentanut Erkki Puranen (Helsinki: Söderström Osakeyhtiön Kirjapainossa Porvoossa, 1952); *Rymdens erövering*, oöversättning av Marcus Lindberg (Helsinki: Schildt, 1952); *La conquête de l'espace* [no tr. mentioned] (Paris: Laffont, 1952); *Die Eroberung des Weltraums : das moderne astronomische Weltbild, jedem verständlich* by Wernher von Braun and Willy Ley mit 19 ein- und vielfarbigen Tafeln von Chesley Bonestell, tr. by Franz Ludwig Neher (Stuttgart: Kosmos, 1952); *Rymdens eroövring* (Stockholm: Rabén &Sjögren, 1952); *Avaruuden valloitus* (Porvoo: WSOY, 1952)
[1214] McCurdy, *Space and the American Imagination*, 33.
[1215] Ley, "Introduction: Mostly About Chesley Bonestell," in *The Conquest of Space*, 11.

into the proper position and have it manned by a good photographer who could use just the right exposure with the proper artistic touch."[1216]

Historians are right to focus on the futuristic and "prophetic" elements of the book. Ley's text complemented the elements of prophecy, as the first chapter dramatically described a rocket launch. In language similar to his earlier book, *The Days of Creation*, Ley placed readers on the "innumerable sand hillocks" of the White Sands Proving Ground, as they anticipate the launch under a hot sun:

> Over all of this, small heat waves are flickering. The sun, almost overhead, is a disk of white-hot steel that burns down on skin and cloth and shoeleather [sic], on sand and sagebrush. It also burns down on the vertical bluish darkness that forms the mountains to the left… Your attention is focused on a point straight ahead, where there is a patch of concrete on the desert sand. In the center of that patch is a small steel structure, really only a steel ring some 6 feet in diameter… Technicians have seen to it that this steel ring is perfectly horizontal. And on that steel ring, but not attached to it, stands a long rocket.[1217]

The text then described the dramatic launch of an unmanned V-2 rocket: "Inside the blockhouse somebody counts off seconds. "Six"—"Five"—"Four"—now the turbine is running—"Three"—"Two"—now the turbine-driven pumps *force* the fuels—"One"—the noise of the rocket has become incredible, deafening; impossible sound wave piled on impossible sound wave—"Zero!"—"Rocket away!"[1218] As the rocket rises, the spectators marvel.

The scene then shifts to a classroom, in which a professor patiently teaches his students about mathematics and rocket trajectories. While encouraging them to "leave all earthbound concepts behind," he brings in concepts from astronomical science.[1219] Ley patiently explains other aspects of rocket technology and space travel, while

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[1216] Ibid., 10.
[1217] Ley, *The Conquest of Space*, 17-18.
[1218] Ibid., 20.
[1219] Ibid., 23-24.

deliberately catering language for the educated layman. The lesson concludes with predictions regarding the scientific uses of an "unmanned orbital rocket" and a space station, which is "a most valuable laboratory."[1220]

Conquest moves into chapter two, called "Target for Tonight: Luna!" Given the prominence of the moon in the history of astronomy, it is a "small wonder" for Ley "that all the speculations, thoughts, and dreams which we are now tempted to label the 'prehistory of space travel,' concerned the moon and the moon only."[1221] Ley then explained the physics of an unmanned trip to the moon. This rocket is technologically feasible and "nearly within reach of present day technology."[1222] Ley conceded:

> There would also be a lot of new problems of all kinds, leading to torn sketches and torn hair in the engineering department and also leading to the loudly expressed realization that a bricklayer has a nice simple life… In general, however… its design and construction are possible without any *major* inventions. Its realization is essentially a question of hard work and money.[1223]

The manned rocket to the moon, on the other hand, "is a different story… beyond our present ability."[1224] Although "the 'how' is still to be discovered," it is easy to imagine such a voyage:

> We know that it will begin with tense minutes of waiting on a mountain top near the equator, above the densest and most troublesome layers of the atmosphere. We know that finally there will be zero hour, zero minute, and zero second… We know that the ship will ride up on the roaring flames, disappearing in the sky in less than a minute.[1225]

Ley then takes readers on the journey to the moon, while Bonestell's illustrations grow closer and closer to the moon's mountains. Readers are encouraged to imagine this dramatic moment of exploration and discovery, as the bold pilot penetrates a new realm

[1220] Ibid., 31-32.
[1221] Ibid., 43.
[1222] Ibid., 46.
[1223] Ibid., 48.
[1224] Ibid.
[1225] Ibid., 49-51.

of nature. Ley described the incredible feat: "The earth will be a monstrous ball somewhere behind the ship, and the pilot will find himself surrounded by space. Black space, strewn all over with the countless jewels of distant suns, the stars."[1226] The third great era of astronomy is now officially underway. Whereas the first great era involved the naked eye and the second great era surrounded the use of instruments on the Earth, this third era ushered in the actual conquest of space. Ley spends much of the remainder of the book discussing the history of astronomical theories, while often arguing, "We'll never know until we get there."[1227] It is amazing how easily Ley blends the past with the future.

The Conquest of Space was an instant hit for Ley. By February of 1950, it had sold almost 20,000 copies.[1228] It was also well-received. One reviewer proclaimed, "Hold your hats, every one! We're off to the moon… So, hold tight! Here we go!"[1229] He added, "But first, be sure you have the Bonestell/Ley guide for the trip—one of the most instructive and entertaining travel books ever published."[1230] John E. Pfeiffer reviewed the book for the *New York Times*. "This book," he wrote, "is the latest and, in many respects, the most fascinating popular account of rocket travel and what people may see when they reach various landing places in the solar system."[1231] He also praised the artwork of Bonestell: "The combination of his picture gallery and Mr. Ley's text makes this one of the year's best popularizations of science."[1232] Very few reviewers critiqued the combination of a popular science writer and a Hollywood artist.

[1226] Ibid., 52.
[1227] Ibid., 71.
[1228] Ley to von Braun, February 8, 1950, WvBP-H, 406-8.
[1229] Richard Blakesley, "We're Off to the Moon! A Travelog," *CDT*, October 16, 1949, H4.
[1230] Ibid.
[1231] John E. Pfeiffer, "Round-Trip Ticket to the Moon," *NYT*, September 25, 1949, BR29.
[1232] Ibid.

In fact, most saw the joint efforts of Ley and Bonestell as logical. According to the *New York Times Book Review*, "It would be difficult to find two men better qualified."[1233]

The book was viewed as scientific and responsible, despite its coffee-table format. According to *The Nation*, the book was "responsible fantasy…admirably suited to the layman who wants something more responsible than Jules Verne or science fiction."[1234] Orville Prescott similarly argued, "This is a strikingly handsome book which might well induce some readers to read less science fiction and more science."[1235]A reviewer for *The Scientific Monthly* even compared it to Renaissance classics: "In the early days of scientific development books were often profusely illustrated. A scientific treatise was not only informative but also a work of art. The revival of this old custom has been successfully achieved in this book."[1236] The book combined Ley's "lucid discussions" of astronomy and spaceflight with Bonestell's work as an "architect, astronomer, and artist… [who] exhibits the well-developed imagination so necessary for this type of work."[1237] Lastly, this "outstanding Viking publication" would appeal to both general readers and "the technical student who wishes to have a reference book he can enjoy."[1238] Other reviewers praised the book widely. Not surprisingly, Robert A. Heinlein wrote a lengthy article for the *Saturday Review*. "Until the first rocket lands on the moon," he announced, "this book is the next best thing to

[1233] Quoted in a large Viking promotional advertisement: "It is X-Hour Minus 5," *NYT*, January 15, 1950, pg. BR7.
[1234] Joseph Wood Krutch, "Responsible Fantasy," *The Nation*, October 1, 1949, 330.
[1235] Orville Prescott, "Books of the Times," *NYT*, December 26, 1949, 27. See also, Edison Pettitt, "Review," *Publications of the Astronomical Society of the Pacific* 61:363 (December, 1949): 269-271.
[1236] Thomas S. Gardner, "Bridge to the Moon," *Scientific Monthly* 70 (January, 1950): 71.
[1237] Ibid.
[1238] Ibid.

interplanetary flight."[1239] On Bonestell's contributions, Heinlein stated, "They are not imaginative fantasies, but realistic renderings, correct in scientific detail."[1240]

By March 1950, the success of *Conquest* convinced the Hayden Planetarium in New York City to "run a show based on the book."[1241] Ley informed Heinlein, "We don't get anything for this directly, but they are going to sell the book in the lobby of the Planetarium which should help. It will run in New York until the end of April, then the whole thing will be packed up and move to the Philadelphia Planetarium."[1242] Heinlein responded in April: "I am awfully glad to hear that 'Conquest of Space' is doing so well. I have heard other reports from Chesley which lead me to think that you boys must be making money at a stupendous rate. More power to you! I hope that the sales keep up forever, and that you become inordinately rich. It's a fine book and I never miss a chance to plug it."[1243]

It would not be long before Ley could afford to move the family back to New York City. Ley probably viewed the royalties as a small bonus. The real success of his book remained to be seen. It would be up to a younger generation to embrace the cause. He wrote to von Braun: "The old guard is too hard-boiled to stop preaching space travel and the younger generation will be, I hope, sufficiently impressed to go on. Some of the explorers of the Arctic have written in their memoirs that they embarked on their career because when they were boys they saw pictures of arctic landscapes."[1244] A new generation would dream of making similar journeys after studying the illustrations of

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[1239] Robert Heinlein, "Baedeker of the Solar System," *Saturday Review of Literature*, December 24, 1949, 9.
[1240] Ibid.
[1241] Ley to Heinlein, March 14, 1950, HA, Box 306-09, "General Correspondence, 1948-1951."
[1242] Ibid.
[1243] Heinlein to Ley, April 17, 1950, HA, Box 306-09, "General Correspondence, 1948-1951."
[1244] Ley to von Braun, WvBP-H, 406-8.

Bonestell. The illustrations would fuel their excitement. Imagination would soar to new heights. Reality would be molded to fulfill the human imagination. Engineers' dreams would influence actions, if the momentum could be sustained.

Chapter 7: The Tom Corbett Years

In June of 1955, Willy Ley went to NBC studios in New York City. They had a special job that required his expertise. He would serve as the brain of TV's space cadet, Tom Corbett, during a public appearance. As actor Frankie Thomas Jr. answered the questions of a large group of young fans, Ley stood behind a curtain, communicating the answers to the actor via a hidden microphone. The *Los Angeles Times* described the scene. A journalist wrote, "If you think conditions around Mars or Saturn are tough for Tom Corbett, you ought to see what headaches he runs into when he comes back to earth!"[1245] He continued: "Hardly had the imaginary jets of his rocket 'Polaris' cooled off in the NBC studios when Mr. Corbett is pelted with the gol-dangdest bunch of questions ever dreamed up by the wizard minds of 20th century boy and girl." His fans asked about rockets, missiles, and space travel. One even asked Corbett to explain Einstein's theory of relativity. With Ley speaking softly in his ear, the actor had no trouble answering the questions in clear and concise terms that the children could understand. When the ordeal was over, the actor reflected, "I might be okay out in space, but I'd sure be lost in those quizzes without Willy… You can't bluff your way through… They ask questions like, 'How can you control direction in a vacuum'—and if you can't answer, you're a 'jethead.'" The actor added, "I thank my lucky stars that Mr. Ley is my co-pilot."

By this point, Ley had done so much to become the man behind the curtain of the Space Age. His *Conquest of Space* had become a best-seller. New editions of his *Rockets* continued to serve as the authoritative book on the subject. While science

[1245] Leslie Lieber, "Whispering Willy," *LAT*, June 26, 1955, H37.

fiction authors used this book as a technical bible, Ley would serve as a technical consultant to television, books, and even a comic strip. Like other scientists-turned-consultants, Ley took advantage of a medium of scientific representations to cater his "re-presentations" of nature to lend rhetorical and ideological support for the cause.[1246] He communicated the language of spaceflight. He outlined narrative frameworks regarding the technology. So many of the images of rockets, space stations, and men in space were influenced by his books, articles, and public lectures. Indirectly, he was influencing millions of people, particularly with his work for Walt Disney. Along with von Braun, Ley even helped to design Disneyland's "Tommorrowland," where American families rode virtual rockets and toured virtual space stations.

It would be impossible to fully explore the myriad of Ley's activities during the early to mid-1950s. A general survey should highlight his importance as a cultural producer, whose representations influenced millions of Americans to believe in the conquest of space. Yet, his successes in popularizing spaceflight need to be situated in his general successes as a science writer, who continued to mix genres and eradicate the distinctions between space and earthbound exploration. His efforts to popularize space travel were smaller components of a broader crusade to educate and entertain, while relentlessly serving as an evangelist for the scientific spirit. By viewing his space-related media *Blitzkrieg* along with a broader crusade to glorify scientists and engineers, historians can contextualize his writings within a broader scene that contributed to postwar technophilia, collective optimism, and flourishing of visual media and experiential sites. Ley's influence can teach historians much about rising public

[1246] See David A. Kirby, "Science Consultants, Fictional Films, and Scientific Practice," *Social Studies of Science* 33 (2002): 232; *Lab Coats in Hollywood: Science, Scientists, and the Cinema* (Cambridge: MIT Press, 2013).

confidence in years prior to Sputnik. The lack of anxieties about a space race with the Soviet Union indicates the flourishing of anti-totalitarian assumptions in the popular realm. Arguably, the lack of anxiety about the space race helps to explain the cultural shock of Sputnik, which will be explored in the next chapter.

Destination Moon

Of course, Ley was only one of many cultural producers who contributed to the scene. [1247] When *The Conquest of Space* hit bookstores, momentum for the cause was growing. The most encouraging sign, besides the sales of books by Ley and other advocates, was the news of a major Hollywood movie, to be produced by George Pal and Paramount Pictures. It was titled *Destination Moon*. By December of 1949, commentators began to speak of a space race between scientists and moviemakers. It was obvious who held the advantage. Philip K. Scheuer wrote, "It looks as though Hollywood will get there first—and in Technicolor."[1248] In some ways, the film was similar to Ley and Bonestell's *The Conquest of Space*. Bonestell was directly involved with the production of the film, which included astronomical backdrops. The film also benefited from the combined efforts of Bonestell and a scientific "expert," due to the

[1247] For notable works of other advocates in the early 1950s, see the works of Arthur C. Clarke: *Interplanetary Flight: An Introduction* (London: Temple Press, 1950); *The Exploration of Space* (New York: Harper, 1951); Prelude to Space (London: Sidwick and Jackson, 1953). See also, Jack Coggins and Fletcher Pratt, *Rockets, Jets, Guided Missiles and Space Ships* (New York: Random House, 1951); Martin Caidin, *Rockets Beyond the Earth* (New York: McBride Co., 1952); *Across the Space Frontier*, eds. Cornelius Ryan and Joseph Kaplan (New York: Viking, 1952); Harold Goodwin, *The Real Book about Space Travel* (Garden City, NY: Garden City Books, 1952); Kenneth William Gatland and Andrew Kunesch, *Space Travel* (New York: Philosophical Library, 1953); Jonathan Leonard, *Flight into Space: The Facts, Fancies, and Philosophy* (New York: Random House, 1953); Heinz Haber, *Man in Space* (Indianapolis: Bobbs-Merrill, 1953); P. E. Cleator, *Into Space* (London: Allen and Unwin, 1953); During this period, George Sutton published the first edition of *Rocket Propulsion Elements: An Introduction to the Engineering of Rockets* (1949). For an interesting collection of articles, see Waldemar Kaempffert, *Explorations in Science* (New York: Viking Press, 1953). Science fiction novels are too numerous to list.
[1248] Philip K. Scheuer, "Hollywood Will Reach Moon First," *LAT*, December 11, 1949, E1.

work of a "No. 1 technical adviser," Robert A. Heinlein.[1249] As the chief consultant, Heinlein strove for scientific accuracy. He used Ley's *Rockets* as a reference text.

Ley had very little to do with this production. This lack of involvement almost ruined his friendship with Heinlein. In June of 1949, Heinlein sent a postcard with technical questions. Ley's responded coolly. After giving a brief answer, he wrote, "Now, having answered a private question… I do wish to tell you that I feel that a movie company ought to pay for information if it wants it… tell them please that I have two children to support, that my time is my merchandise and that it is, therefore, for sale."[1250] Obviously, Ley felt quite hurt that Heinlein did little to include him in the production. Ley may have also viewed the situation in terms of a friend's betrayal.

When Heinlein received Ley's response, he immediately wrote a long letter. In part, it read, "You will remember from our last meeting that I wanted you as technical director… That's what I asked for on this picture, but I did not get it. It is a pinch-penny budget and there was no way to offer you a contract."[1251] Heinlein added his reason for sending the question: "I guess I was too goddam [sic] subtle, but the purpose of that question was simply to 'invite you into the club,' let you know that you had not been forgotten, were not being ignored."[1252] Heinlein claimed that he wanted to "show deference" by asking. He ended the letter by suggesting that they avoid all correspondence on space travel until the picture is released.[1253]

[1249] Ibid., 2.
[1250] Ley to Heinlein, June 28, 1949, HA, Box 306-09, "General Correspondence, 1948-1951, section 2."
[1251] Heinlein to Ley, June 30, 1949, HA, Box 306-09, "General Correspondence, 1948-1951, section 2," 1.
[1252] Ibid.
[1253] Ibid., 2. He added that Ley was "more than welcome on the set," so long as his presence did not put Heinlein in "an impossible position" of taking the advice without being able to compensate Ley.

Ley responded two months later, after Heinlein wrote a generous review of *Conquest*. Ley thanked Heinlein for the review. Then, turning to the "misunderstanding," Ley wrote a less defensive response that corrected Heinlein's version of events:

> I had not heard from you for some time… In case you don't know it, to anybody East of the Mississippi… the word movie smells of cash… For all I knew you were working for MGM or Mr. Goldwyn personally. You hadn't said anything before, nobody else knew anything… and I didn't see why I should help MGM. If you had made it clear from the outset that you were bringing personal sacrifices my reaction would have been personal too, -- instead of the attitude of self-defense… So that dog is daid [sic]."[1254]

Ley would have other opportunities to influence a mass audience.

Tom Corbett, Space Cadet

In October of 1950, a television show premiered on the CBS network.[1255] It was the first episode of one of the longest running television programs in the early 1950s. The show began: "Kellogg's, the greatest name in cereals, presents Tom Corbett: Space Cadet." An image of a V-2 rocket cuts to a control room, as the show announced:

> This is the age of the conquest of space. 2350 A.D: The world beyond tomorrow. Here at Space Academy, U.S.A, the youth of the universe trains for duty on distant planets. In roaring rockets, the space cadets blast through the millions of miles from earth to the far-flung stars, to protect the liberties of the planet, defend the freedom of space, and safeguard universal peace.[1256]

The show's introduction continued to mix V-2 rocket footage with crude models of Space Academy.

[1254] Ley to Heinlein, October 1, 1949, HA, Box 306-09, "General Correspondence, 1948-1951, section 2," 2.
[1255] The show would migrate from network to network throughout its lifespan.
[1256] *Tom Corbett, Space Cadet*, Episode 1 "The Solar Guard Academy," part 1 of 3

The scene shifted to the space cadets chanting, "Safeguard the freedom of space… and uphold the cause of peace throughout the universe… To this end, I dedicate my life…"[1257] Then, an incoming rocket ship hailed, demanding to speak with Captain Strong, because the "safety of earth depends on it… the safety of earth and the whole solar alliance!"[1258] Viewers soon meet cadets Tom Corbett, Astro, and Roger Manning, as they attend a lecture at space academy. Captain Strong began:

> As you all know, 400 years ago, the first rocket ship left the earth and broke through the barriers of space. The universe was opened, and the people of Earth came into contact with the people of Mars, and then Venus… But, there was conflict, mistrust… wars were fought… cities, countries, whole civilizations were destroyed… until, finally, 100 years ago, we reached the age of reason and the Solar Alliance was created. The Solar Guards were formed to ensure the liberty and the freedom of all peoples. You, as Space Cadets, will now start training to become officers of the Solar Guards. Your responsibilities are great, men. You hold the future of the Solar Alliance in your hands… There are people to be met and understood, but remember this, and remember it well… you'll meet them as men of peace. You'll deal with them in honor and trust. You'll fight only for freedom and for liberty.[1259]

The lecture is soon interrupted when Strong is summoned to Space Port Control. Astro and Tom grow concerned. "By the rings of Saturn," Astro proclaims, "I bet there's trouble somewhere."[1260] Roger Manning immediately establishes his tone, with "Go on… it's a lot of space gas… they get steamed up over nothing in this place."[1261] Manning then adds, "Did you hear that song and dance about fighting for peace and freedom? Why they outlawed guns over a hundred years ago. What are we going to fight with… books or magniscopes?"[1262] As Manning's antagonist, Astro responds by turning to Tom, "My friend, it seems to me that there's a lot of space gas being sprayed

[1257] Ibid., 1:06-1:27.
[1258] Ibid., 2:30-3:00.
[1259] Ibid., 4:30-6:15.
[1260] Ibid., 6:46-6:48.
[1261] Ibid., 6:51-6:59.
[1262] Ibid., 7:00-7:10.

around right now."[1263] Tom jokes, "Yes, I smell it too."[1264] Manning retorts, "Ah, a couple of good little space scouts, aren't we? Gonna do or die for the Academy, I suppose. Grow up, juniors."[1265] This comment sparks a verbal confrontation between level-headed Tom, easily-angered Astro, and cynical Roger. "Look," Tom responds, "if you think this is a lot of meteor dust, why did you come here in the first place?"[1266] Manning responds that he is at Space Academy to get an easy education, which he will use to fly commercial rockets after graduation. He adds, "Only suckers would fall for that routine about soldiers of peace and freedom."[1267] Astro can take no more. He lunges at Manning while yelling, "By the craters of luna, I'll…"[1268] Tom intervenes, preventing a fight by saying, "Hey, easy there. Don't blast your jets."[1269]

In the next scene, we see Captain Strong in the control room, attempting to assist an incoming rocket that has yet to "turn tail."[1270] The captain of the ship is disoriented. He warns Strong, "watch for men of…"[1271] After a not-so-quick word from the sponsor, Astro introduces Tom to the "rocket-cruiser of the latest design" called the *Polaris*. "It's beautiful," Tom exclaims, "the most beautiful thing in the whole world."[1272] Astro responds with a long monologue:

> Aye… and one day if you're lucky, you'll be the master of such a ship as this. You will walk her decks a million miles out in the void, stare out of the view ports into the majestic blackness of outer space. You will see planets, asteroids… worlds dead and worlds still unborn. Then, by all the satellites of Jupiter… Then, Tom, you will know what it means to be a space man![1273]

[1263] Ibid., 7:11-7:15.
[1264] Ibid., 7:16-7:17.
[1265] Ibid., 7:17-7:23.
[1266] Ibid., 7:24-7:28.
[1267] Ibid., 7:36-7:43.
[1268] Ibid., 7:43-7:44.
[1269] Ibid., 7:44-7:45..
[1270] Ibid., 9:39.
[1271] Ibid., 10:01-10:08.
[1272] Ibid., 12:04-12:09.
[1273] Ibid., 12:11-12:42.

"You make it sound pretty wonderful," Tom responds. Suddenly Astro and Tom notice the incoming rocket. "He's just falling out of control!"[1274] Captain Strong rushes to the boys, forcing them to the ground to take cover. A nearby explosion and flames make it clear that nobody survived the crash. "It's all over… the end for them," Astro laments.[1275] Strong responds, "For them, yes. I'm afraid it's only the beginning… for us."[1276]

Airing at 6:45pm, three times a week, *Tom Corbett: Space Cadet* narrated the daring 24th-century adventures of a young man and his small crew, as they journeyed through the solar system on a V-2 inspired rocket.[1277] As cadets of "Space Academy, U.S.A." (later changed to "Atom City"), the crew rocketed into the cosmos, where they enforced the laws of the Solar Guard and combated the mechanical failures of the rocket. Often, the central conflict involved the clashing personalities of the main characters. Comic relief came in the form of space slang, such as "Cool your jets!" "Great Rings of Jupiter!" and "Blast me for a Martian Mouse!"

Tom Corbett was not the first spaceflight program to appear on television. It followed in the footsteps of *Captain Video* and *Space Patrol*. However, the show distinguished itself as the most plausible. *Newsweek* commented, "Space Patrol and Captain Video shows sometimes extend action beyond the possible, but the Tom Corbett program makes a point of keeping actions within the limits of scientific

[1274] Ibid., 13:04-13:05.
[1275] Ibid., 13:31-13:34.
[1276] Ibid., 13:38-13:41.
[1277] For broadcast information, cast, and summaries, see George W. Woolery, *Children's Television: The First Thirty-Five Years, 1946-1981, Part II: Live, Film, and Tape Series* (Metuchen, N.J. and London: The Scarecrow Press, 1995).

accuracy."[1278] Although early scripts contained some wild ideas, "Ley will have straightened out most of them."[1279] Consequently the show "generally provides its audience with possible—though still unrealized—facts, and juvenile watchers are getting science lessons along with their entertainment."[1280]

Although Ley did not preserve much of his correspondence and work related to *Tom Corbett*, the evidence suggests that he was quite involved. Certainly his duties did not consume too much of his time.[1281] Ley often gave the impression that his work for *Tom Corbett* was an insignificant side-gig that only tangentially related to his "professional" scientific pursuits. For example, in a 1957 interview, Mike Wallace commented to Ley: "You're most widely known and respected as one of our most reliable science reporters." Wallace could barely contain his laughter when he asked: "Does it ever bother you that you're also known as a consultant for the science fiction TV series *Tom Corbett: Space Cadet*, and… as a special advisor to the Sugar Jets cereals' space commercials on ABC's *The Mickey Mouse Club*?[1282] Without missing a beat, Ley responded, "Well, no that doesn't bother me at all, because if I weren't there, I feel somebody else might do it and talk nonsense. So, I almost feel like an educator by bringing in things which I consider correct."

Yet, in personal correspondence, Ley displayed confidence and hope for the show. He told Heinlein in May of 1951, "There are all kinds of things brewing right

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[1278] "Hi-yo, Tom Corbett!" *Newsweek*, April 2, 1951, "Radio Television."
[1279] Ibid.
[1280] Ibid. *Newsweek* concluded, "If the moon is experimentally reached by man-carrying rockets in 25 years, as Ley predicts, it will be rather old stuff to many of today's youngsters."
[1281] In May, he told Heinlein, "It takes about two half days per week, and every month I mail a statement 'for professional services' $500.00." Ley to Heinlein, May 4, 1951, HA, Box 306-09, "General Correspondence, 1948-1951, section 2," 2.
[1282] "Interview" *Night Beat*, with Mike Wallace, summer 1957, 18:32. Available at The Willy Ley Collection, University of Alabama-Huntsville.

now, much of it in connection with Space Cadet."[1283] He added, "Mind you, I don't claim that the show is perfect as of now. But it has much improved and there is hope that it will be something to be proud of in a few months."[1284] At a time when many literary critics damned television and its effects on children, Ley embraced the potential of the medium to both educate and entertain.[1285] Like Don Herbert (whose *Watch Mr. Wizard* appeared in 1951), Ley perceived an enormous opportunity to bring science into the homes of American families.[1286]

Additionally, Ley influenced the show's massive publicity campaign. After "the central office of the show had received request [sic] from various small towns to send the actors for personal appearance," they sent Thomas and his supporting cast to Pittsburgh, Philadelphia, and Boston. These public appearances generated crowds and useful publicity. Thomas remembered a particular appearance in Philadelphia: "There was a line all the way out the door—there were 10,000 people there! I was shaking hands and saying, 'Spaceman's luck!' and all of that… there wasn't *time* to sign autographs."[1287] While this estimate is likely exaggerated, the show's marketing campaign was unprecedented for a juvenile television program. In some ways, it was formulaic, attempting to recreate the "craze" of *Hopalong Cassidy*. The show's licensee contacted clothing manufacturers to design space cadet apparel. Meanwhile, the show's first advertiser, Kellogg's cereal, included *Tom Corbett* decoder rings, among other

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[1283] Ley to Heinlein, May 4, 1951, HA, Box 306-09, "General Correspondence, 1948-1951, section 2," 1.
[1284] Ibid., 2.
[1285] For an interesting account of these tensions, see Eric Burns, *Invasion of the Mind Snatcher: Television's Conquest of America in the Fifties* (Philadelphia: Temple University Press, 2010).
[1286] See Marcel C. LaFollette, "A Survey of Science Content in U.S. Television Broadcasting, 1940s through 1950s: The Exploratory Years," *Science Communication* 24 (September, 2002): 34-71.
[1287] Interview with Frankie Thomas, in "Frankie Thomas on Tom Corbett, Space Cadet," in *Earth vs. the Sci-Fi Filmmakers: 20 Interviews* (by Tom Weaver) (Jefferson, North Carolina and London: McFarland & Company, 2005) 352.

toys. When Ley discovered that an apparel convention in New York City included the promotion of works by Bonestell, Heinlein, and himself, he suggested that they amp up the marketing campaign.[1288] Particularly after the success of a Pittsburgh meet-and-greet, Ley recalled:

> It was so successful that it was decided to do this again, but not just with a few uniformed actors. At about that time I entered the picture and they began thinking about adding my book, especially a few cut-up portions of Bonestell pictures under glass. Whereupon I said: why not Bonestell originals. Why not a few actual rockets? So now there is a combine consisting of the Tom Corbett program, the Viking Press and the Hayden Planetarium (I brought them all together) working on a permanent exhibit, designed to travel.[1289]

Regarding Ley's contributions to the show, Frankie Thomas, Jr. recalled, "When I was writing some of the *Corbett* shows with my writing partner Ray Morse… I would have a conference with Willy, and it was amazing, the things that he said *we could do*, things which he said *were* in the realm of scientific possibility."[1290] Although Ley complained about the show's use of a "Paralo-Ray," he generally approved most of the writers' ideas. Thomas remembered, "He would check your story's 'scientific possibility'—those were the words he used—and if it was scientifically possible, okay, go ahead with the story! I had very few problems with him, everything I came up with, he okayed."[1291] Unlike *Space Patrol* and other shows, "we didn't go for horror stuff. We tried to stick with 'the scientifically possible.' We were totally different from *Space Patrol*. They had monster show and Dracula-like characters. We had man-against-man a little, man-against-nature and man-against himself."[1292] Thomas added, "all our stories were run by Willy Ley, and he would make sure that the stories involved things that

[1288] Ley to Heinlein, May 4, 1951, see previous citation.
[1289] Ibid.
[1290] Interview with Frankie Thomas, 357-358.
[1291] Ibid.
[1292] Ibid., 359.

were scientifically possible. They didn't have to exist, but they *could* exist."[1293] Ley also took pride in this work, telling Heinlein, "So far I have no complaints. Fortunately most of the people involved got their first 'familiarization' by reading my books, so they listen when I open my mouth… I veto scientific impossibilities."[1294] His biggest complaint surrounded the setting of the show in the 24th century.[1295] This future would unfold much sooner.

A survey of the television show, along with its novels and comic strips, reveals the influence of Ley's veto power, as well as his incorporation of science lessons.[1296] In particular, the *Tom Corbett* comics often contained basic science lessons.[1297] For example, a piece that ran on December 16th, 1951 narrated the crew's adventures on "Luna Station," as they dodged a meteor shower.[1298] One character exclaims, "I-I can't get used to Luna! On Earth, the atmosphere burns up almost all meteors before they land! There's no atmosphere here, and we're hit by 2,000 a day!" The comic then presents a diagram of "Planet X," which is "the original fifth planet between Mars and Jupiter (now broken up to form the asteroid belt)."[1299] It also includes a brief explanation of the largest meteorite found in Africa. Other installments incorporated lessons in the history of science, or basic astronomical facts.[1300] Obviously, Ley was

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[1293] Ibid.
[1294] Ley to Heinlein, May 4, 1951, 1.
[1295] "Hi-yo," *Newsweek*, "Radio Television."
[1296] See Carey Rockwell, *On the Trail of Space Pirates* (Grosset & Dunlap, 1953); *Stand by for Mars!* (1952); *Danger in Deep Space* (1953); *The Space Pioneers* (1953); *The Revolt on Venus* (1954); *Treachery in Outer Space* (1954); *Sabotage in Space* (1955); *The Robot Rocket* (1956). See also, Marcia Martin and Frank Vaughn, *Tom Corbett's Wonder Book of Space* (New York: Wonder Books, 1953).
[1297] These comics appeared in several regional newspapers, including the *Philadelphia Inquirer*, the *New York Herald-Tribune* and *Washington Star*. They were syndicated through the *Chicago Sun-Times*.
[1298] *Chicago Sunday Sun-Times*, Comics, Sunday, December 16, 1951, 1. Several copies can be found in WLC, Box 10, Folder 5: "Newspaper and Press Clippings featuring Ley, 1951-56."
[1299] The *Tom Corbett* comics also included diagrams relating to the construction of a space station. See November 4, 1951.
[1300] Date unknown, see WLC, Box 10, Folder 5.

using every medium at his disposal to educate and excite audiences about a future of interplanetary travel.

Rockets, Missiles, and Space Travel (1951)

During this time, Viking Press published a new edition of *Rockets*, now titled *Rockets, Missiles, and Space Travel* (1951). In Ley's perspective, it was a new book, extensively rewritten and revised with additional material.[1301] Ley told a reporter, "The new book is essentially a history of the development of rockets from the beginning to the future, to the moonship, to landing on the moon and building a base there… It is a history up to the present. After that it is prophecy."[1302] Because Ley was now using the ex-Peenemünders as sources, one might expect the book to match Neufeld's description of a trend in German rocket historiography that became entrenched in Huntsville: "a romanticization of the Nazi rocket center… as fundamentally aimed at space travel, rather than weapons development for Hitler…"[1303] This romanticization does creep into the text. Ley described the initial site as "strung along the seashore, with laboratories, workshops, test stands, etc." Ley even asked if the site should be thought of as "a research engineer's paradise," even though the engineers were "operating for the wrong cause."[1304] "Actually," he explained, "there were fantastic ups and downs, reflecting directly the fortunes of war as seen from Berlin."[1305] Ley's book also included dramatic countdowns of V-2 launch tests, which could parallel the language of his spaceflight books. Nevertheless, the text is very clear about the V-2 rocket being a weapon of war,

[1301] Willy Ley, *Rockets, Missiles and Space Travel* (New York: Viking, 1951).
[1302] Harvey Breit, "Talk with Willy Ley," *NYT*, July 22, 1951, I56.
[1303] Neufeld, "Creating a Memory," 73.
[1304] Ley, *Rockets* (1951), 197.
[1305] Ibid.

commissioned for only one purpose: as a missile. It is also interesting that Ley wrote very little about the motivations of von Braun and others.

By this point, Ley's *Rockets* had grown to 436 pages. His agenda had changed. Whereas his 1944 edition tried to persuade the public "that he was serious."[1306] Ley asserted, "The question now is simply how soon engineering practice will catch up with existing theory."[1307] As a result of this changing agenda, the text of his book became far more complicated and often bogged down with equations and diagrams. Ley was trying to write for both laymen and specialists. He struggled to balance a readable text with technical diagrams and appendixes. Consequently, many reviewers saw the book as "more imposing" than earlier editions.[1308] This complexity led one reviewer to state, "If you find these suggestions [of space travel] a little dizzying, other pages of Mr. Ley's text, in which he calculates mass ratios, exhaust velocities and speeds for interplanetary travel, may dizzy you still further. He writes as a rocket scientist, with a kind of mathematical fury which may baffle well meaning laymen who never got beyond trigonometry."[1309] Yet, even this critical reviewer admits, "Mr. Ley can be technical, but he has an appealing sense of wonder and a wonderful sense of curiosity."[1310] Other reviewers could be far more critical.[1311] Despite these critical reviews, the book sold well. The "Natural History Book Club" heavily promoted it by gifting it to new

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[1306] Lewis Gannet, "Books and Things," *New York Herald Tribune*, June 29, 1951, page obscured by WLC clipping.
[1307] Ibid.
[1308] "Science Fiction Bookshelf," *Startling Stories*, November 1951, 142.
[1309] Gannet, "Books and Things," page unknown. See also, Joseph Wood Krutch's technical review of the book in *The Nation*, August 25, 1951, 155.
[1310] Ibid.
[1311] For example, Roy Gibbons wrote, "Sometimes, you wonder, after reading a book such as this, just what the scientists are up to in their strange mutterings…" He then asked, "why serve it up inside slick covers at these prices, when the subject for now is strictly a pipe dream dished up regularly at two bits a copy in the pulps?" See Roy Gibbons, "All Aboard for Trip to Moon or Some Such," *CDT*, August 12, 1951, B10.

members.[1312] They downplayed the technicalities of the book, announcing, "Here is the story of the rocket from its beginning. And here is a simplified account of present-day developments along with the thrilling story of the triumph over space that is soon to come."[1313] Ley's book was read as prophecy that would become reality.

A Media Blitzkrieg

Throughout 1950 and 1951, Ley spent much time as a public educator, attempting to inspire his audience. He continued to tour the lecture circuit, which took him to clubs, planetariums, hotel conferences, and even NACA's Langley Field, where he spoke to engineers from nearby shipyards and "a number of people from Norfolk Navy Base."[1314] Common lecture themes included "New Horizons—Conquest of Space," and "The Present Status of Space Rockets."[1315] He also appeared on television and radio. Ley participated in various "youth forums" in New York City. For example, he appeared with Hal Clement and Groff Conklin to speak about science fiction literature at the *New York Times* Youth Forum.[1316] He also participated in the "WGY Science Forum."[1317] Often, he accepted local invitations to speak at high schools or other small venues.[1318]

His lectures and publicity activities served as a double-edged sword. He informed Heinlein, "I'm lingering a lot in front of TV cameras and other things like

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[1312] "Display Ad 971," *NYT*, September 30, 1951, 178.
[1313] Ibid.
[1314] Ley to Heinlein, November 25, 1951, HA, Box 308a-3, "General Correspondence, 1952," 1.
[1315] Key lectures included "New Horizons—Conquest of Space," and "The Present Status of Space Rockets," hosted by the *Chicago Sun-Times* and The Adler Planetarium, December 15th, 1951;
[1316] "TV Blamed Anew as Rival of Books," *NYT*, November 18, 1950, pg. 18. See also, "World View Taken by Young Readers," *NYT*, November 19, 1950, 79.
[1317] See *Mike and Camera*, March 1951, 9.
[1318] See "Authority On Space Ships Will Speak Her Tuesday," *The Garden City News*, April 19, 1952.

that. But this, unfortunately, is not a direct indicator or income. I don't complain, but most of that stuff is merely publicity and does not bring anything in directly. In fact it takes time which might be gainfully used… these 'honors and diversions'… prevent me from writing."[1319] Ley related his situation to an unfortunate cycle, in which the more time spent writing generated a demand for public appearances, yet the periods of lectures and interviews served as less productive moments. If he did not keep writing, then there would be less demand for lectures. Yet, if he did not take breaks from writing, then there would be less publicity.

During this period, Ley continued to write educational and entertaining articles, designed to teach ordinary Americans about the imminent future of space travel. Most notable was Ley's cover story for *The Philadelphia Inquirer Magazine*. In "You'll Live to See a Spaceship," Ley predicted, "I think it is fairly safe to say that more than half of the readers of this article will live to see a spaceship."[1320] After comparing the critics of spaceflight to earlier skeptics of air travel, Ley summarized the history of the V-2 rocket. He then argued, "As rocket technology stands right now, we could, with the fuels at our disposal, send an unmanned rocket to the moon to crash there, making a mark which could be observed from the earth through a telescope."[1321] He added, "This is as far as we can go with chemical fuels. For a spaceship which is able to carry a pilot and passenger or two and which is capable of taking off, going to the moon, landing there and returning to earth after a while, something else has to be called to our aid:

[1319] Ley to Heinlein, November 25, 1951, 1.
[1320] Willy Ley, "You'll Live to See a Spaceship: The First Rocket Will Leave the Earth in 1965 or 1970," *Today… The Philadelphia Inquirer Magazine*, November 16th, 1951, 9. This article was also syndicated in the December edition of *Science Digest*. See also, Willy Ley, "Out of this World by Spaceship," *NYT*, June 22, 1952, BR1. This article contains Ley's review of Arthur C. Clarke's *The Exploration of Space*.
[1321] Willy Ley, "First Spaceship by 1970!" *Science Digest*, December 1952, 13.

Atomic energy."[1322] Ley predicted a seamless application of atomic power to rocketry, before claiming, "There is no reason to believe that we won't get there. Thinking about this now is like thinking about transatlantic air flights in 1914."[1323] In an interview with the *New York Times*, Ley made similar statements, arguing, "The man-carrying ship requires… the application of atomic energy to rocket propulsion. I am not an atomic scientist. I don't know how it can be done. But this is the only thing that stands between us in 1951 and actual space travel."[1324] If the imagination of Americans could be stoked, that future would be inevitable.

Dragons in Amber

In 1951, Ley published a follow-up to his revised and expanded *Lungfish* (1948). He titled the sequel as *Dragons in Amber: Further Adventures of a Romantic Naturalist*.[1325] The new title of this book had two meanings. On the one hand, it simply referenced the fossilized remains of prehistoric reptiles, which could be found inside of pieces of amber. These types of "records in stone" are documented throughout the first part of the book, as Ley discusses "footprints in the red sandstone" and "the mammal from the permafrost." On the other hand, the title of the book is much broader, because it refers to hidden "gems" of knowledge that could be rediscovered by the curious onlooker. These stories of interesting animals, places, and eras represented amazing case studies in the history of science.

[1322] Ibid., 13.
[1323] Ibid., 14.
[1324] Breit, "Talk with Willy Ley," I56.
[1325] Willy Ley, *Dragons in Amber: Further Adventures of a Romantic Naturalist* (New York: Viking Press, 1951).

In the book's forward, Ley stated the rationale for the sequel. For the same reason that he wrote *Lungfish*, he wrote *Dragons* "because nobody else had."[1326] Ley elaborated: "In looking over the table of contents I am surprised by one thing. Natural history is generally regarded as a rather static science which had its heyday and its revolutions during the nineteenth century. For a static science, a lot has happened to it during the two and a half decades since I sat in college lecture halls hearing about those same subjects." Ley expressed astonishment at the fact that learned men of science viewed natural history in this way, while they simultaneously made authoritative statements that were baseless or unimaginative. These learned men of science felt safe to make authoritative statements, while they dismissed natural history as a preoccupation of the past. Consequently, Ley debunked their proclamations and predications, while simultaneously celebrating recent discoveries and "revolutions."

Although the book clearly has a presentist agenda, Ley never misses an opportunity to trace the history of a science back to its earliest investigators. For example, with two chapters devoted to the history of amber, Ley documents the early theories of Pliny the Elder and Cornelius Tacitus, while cross-referencing passages from Homer. After "the first period of the cultural history of amber," Ley then moves into the medieval period.[1327] He discusses amber's role in the production of rosaries, as well as laws surrounding its collection in the Samland. He subsequently narrates a more scientific period of "systematic botany" and "geological reasoning."[1328] Men of science "pushed… further in the logical, and, as it turned out later, the correct direction…"[1329]

[1326] Ibid., vii.
[1327] Ibid., 13.
[1328] Ibid., 20-21.
[1329] Ibid., 21.

A watershed moment occurred when the Prussian state monopoly on amber production collapsed in the early nineteenth century. With politics and religion out of the way, "the combination of new management on the commercial end and new science on the explanatory end… was finally able to solve the amber problem."[1330] The geologist was suddenly free to investigate. As such, the scientist served as a "new factor, one which gave… a virtual certainly of success."[1331] Ley explains, "the scientist could no longer be restrained."[1332] Ley traces other developments, while debunking "a lot of nonsense… written about amber in trade journals and on some occasions even in professional scientific publications…"[1333] He also recounts the history of fakes and hoaxes, before concluding with a brief comment on the geological history of the earth.

Overall, a common narrative emerges surrounding fossils and the development of paleontology. Ley celebrates the curiosity and achievements of the Greeks, although he laments the intrusion of mythology into natural philosophy. He documents the long struggle of a science out of the darkness of medieval thought. Later men of science had to overcome medieval prejudices as well as misguided attempts to attribute fossils to the bones of "sinners who had drowned in the Flood."[1334] Regarding larger bones and fossils, "There came a time, of course, when the big bones dug from the ground no longer frightened people…"[1335] Science progressed most in areas that allowed for increased skepticism, an open-minded evaluation of evidence, and the international

[1330] Ibid., 22.
[1331] Ibid., 29.
[1332] Ibid., 29
[1333] Ibid., 41.
[1334] Ibid., 75.
[1335] Ibid., 98.

exchange of information and specimens. If a society became closed or far too parochial, then science was not possible.[1336] The true history of science was an international story.

Reviewers loved the "second Lungfish." Esteemed literary critic Orville Prescott commented in the *New York Times*, "Readers who recall Mr. Ley's earlier book… know with what zestful enthusiasm Mr. Ley can write about the wonders of the natural world."[1337] On Ley's style, Prescott added, "He has discovered that a popular touch doesn't depend on heavy breathing and high-pressure writing."[1338] Prescott concluded:

> Mr. Ley roams all across the world and backward in time to the age of reptiles. He tells odd stories, collects curious facts and explains scientific methods. It is all marvelously educational and Mr. Ley is a good teacher. If my college biology professor had possessed one-tenth of Mr. Ley's imagination and showmanship I would not have had half so much trouble passing his course.[1339]

In sum, "he knows how to make his interest contagious."[1340] In the *Chicago Tribune*, August Derleth called it "science at its best."[1341] He added, "What Willy Ley does is to make science as fascinating as any fiction."[1342] Not only did Ley make science readable for non-specialists, he "explores the avenues of scientific knowledge all too often neglected by literate scientists."[1343] Unlike a typical scientist, Ley's "persuasive charm… transcends most of the best scientific writing for the general reader available today."[1344] Thus, the book was "no mere popularization of natural science."[1345] Instead, "it is an account, written with a spirited imagination and a lively sense of humor, in an

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[1336] Ibid., 139. For example, Ley wrote of China: "The Chinese boasted of their old and elaborate culture… But they did not have science in our sense. They also were remarkably reluctant to indulge in international cooperation, without which science is impossible."
[1337] Orville Prescott, "Books of The Times," *NYT*, February 12, 1951, 20.
[1338] Ibid. It is interesting to read Prescott praise in the context of his broader campaign against television and its effects on children. See Burns, *Invasion of the Mind Snatchers*, 21.
[1339] Ibid.
[1340] Ibid.
[1341] August Derleth, "A Scientific Adventure in Romance," *CDT*, January 28, 1951, H4.
[1342] Ibid.
[1343] Ibid.
[1344] Ibid.
[1345] Ibid.

easily read style, of lesser wonders which are within reach of the man on the street, the enduring wonders of his own world which existed long before his time and are likely to mystify his race generations hence."[1346]

Not only would the "man on the street" learn about these "enduring wonders," but also professional scientists would benefit from a close reading. None other than famous biologist Julian Huxley proclaimed, "The book as a whole is excellent, and will agreeably introduce its readers (including professional biologists) to many exciting facts and fascinating ideas."[1347] Huxley added that Ley was "a master in a rather unusual technique of popular science… The method illustrates the romantic excitement of the scientific quest itself, and links it with history, economics and politics in a fascinating and often illuminating way."[1348]

Others saw very few contradictions between Ley's works on space travel and his adventures as a "romantic naturalist." Joseph Henry Jackson wrote, "If Ley enjoys projecting himself into tomorrow… he is equally happy in projecting himself into the day before yesterday… Mr. Ley describes himself as a 'romantic naturalist' and perhaps, in the pleasure he takes in projecting himself into the past, he is one."[1349] There was also nothing contradictory about Ley's scientific mind and his "romantic temperament."[1350] Jackson stated: "In this book, Mr. Ley ranges back over some of these oddments, brings his reader up to date, adds tidbits of reflection and comment, and altogether disports himself accurately, scientifically, and in the manner of a man

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[1346] Ibid.
[1347] Julian Huxley, "The Romance of Nature," *The Observer*, October 21, 1951, page unknown. See clipping in WLC.
[1348] Ibid.
[1349] Joseph Henry Jackson, "Bookman's Notebook," *LAT*, February 1, 1951, A5.
[1350] Ibid.

having a very good time indeed."[1351] Consequently, he makes science fun, particularly for the lay reader: "And if you wonder just where it gets you to know all these things—well, a lot of people enjoy learning just for its own sake. Mr. Ley has what amounts to real genius for tapping this native curiosity in his readers, and for making them like it."[1352] Similarly, C.P. Swanson wrote, "Biology is fortunate in having so gifted a pen at its disposal."[1353]

A New York Symposium

While he continued to excite readers about the wonders of the earth, Ley also served as the chief organizer for the first of three conferences on space travel. Ley recalled the origins of the idea in his 1957 edition of *Rockets*. "One day, a nice spring day in 1951, I had lunch with Robert Coles, then the chairmen of the Hayden Planetarium in New York."[1354] The discussion soon turned to the many "astronautical congresses which were then just starting in Europe, international meetings of rocket experts and space-travel enthusiasts…"[1355] Ley lamented the "skimpy" American attendance at these meetings. It was too much of a financial burden for Americans to attend such events. Ley recalled, "Maybe, I said, there should be an American equivalent to these congresses. The annual meeting of the American Rocket Society were always fine, but only one session was devoted to space travel, while the European

[1351] Ibid.
[1352] Ibid.
[1353] C. P. Swanson, "Review," *The Quarterly Review of Biology* 27 (March, 1952): 77.
[1354] Ley, Rockets (1957), 330.
[1355] Ibid.

congresses were devoted to nothing else."[1356] After Ley paused, Coles said, "Go ahead, the planetarium is yours."

Sponsored by the Hayden Planetarium, the "First Annual Symposium on Space Travel" occurred on Columbus Day, 1951. The symbolism was obvious. As an exclusive, invitation-only event, the symposium brought specialists and journalists together. Not only did Ley send invitations to "institutions of learning" and "professional societies and research groups," but he also contacted the "science editors of metropolitan newspapers and magazines…"[1357] The journalists became the most important attendees, due to the symposium's promotional goals. Ley argued, "The time is now ripe to make the public realize that the problem of space travel is to be regarded as a serious branch of science and engineering."[1358] If the specialists could communicate their exciting ideas, then the journalists, in turn, would excite the broader public.

According to the program, Dr. Albert E. Parr of the American Museum of Natural History gave the opening remarks. Robert R. Coles followed by presenting an imaginary tour of Mars, as seen through one of the Hayden Planetarium's "Conquest of Space" exhibits.[1359] Then, Ley addressed the crowd with "Thirty Years of Space Travel Research." He reflected on past achievements in rocketry, while predicting that rockets could soon orbit the earth and beyond. Eventually, he argued, nations would construct

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[1356] Ibid., 331.
[1357] Quoted in McCurdy, *Space and the American Imagination*, 35: Original source listed as Willy Ley, letter of invitation, First Annual Symposium on Space Travel, 1951, American Museum of Natural History, Hayden Planetarium Library, New York, N.Y.
[1358] Ibid, quoted in McCurdy, *Space and the American Imagination*, 35.
[1359] Quoted in McCurdy, 36. Original source quoted as: Robert R. Coles, :The Conquest of Space, First Annual Symposium on Space Travel," 13 October 1951, American Museum of Natural History.

stations in space.[1360] During the next afternoon, Ley, along with planetarium chairs Coles and Haviland, appeared on the Nancy Craig television program.

This symposium had a minimal impact on the general public, yet it set in motion a chain of events that would serve as a "watershed" moment. Most importantly, the symposium intrigued the editorial staff of *Collier's* magazine, which had a circulation of 3.1 million readers. Managing editor Gordon Manning sent associate editor (and notable journalist/writer) Cornelius Ryan to New Mexico, where he attended a less-publicized symposium on "space medicine."[1361] Although Ley did not attend this symposium, it attracted several well-known experts like Wernher von Braun and Joseph Kaplin. It also attracted astronomer Fred. L. Whipple, who later recounted the events that took place behind the scenes.[1362] Apparently, Ryan attended the talks, yet he remained skeptical and often confused by the technicalities. Yet, he was soon converted to the cause, after a night of dining and cocktails with von Braun, Whipple, and Kaplin. "The three of us," Whipple recalled, "worked hard at proselytizing Ryan and finally by midnight he was sold on the space program."[1363] Von Braun, in particular, displayed his talents as "one of the best salesmen of the twentieth century."[1364] Not only did Ryan support the cause, but also he soon agreed to serve as editor of two books: *Across the*

[1360] See McCurdy, 36. Source: "Thirty Years of Space Travel Research, " and American Museum of Natural History, "Space Travel Symposium Held at Hayden Planetarium," 12 October 1951, American Museum of Natural History. More specialized talks by engineer Robert P. Haviland, astronomer Fred L. Whipple, medical expert Heinz Haber, and legal expert Oscar Schacter followed these remarks.
[1361] Much of the following account comes from McCurdy.
[1362] See Fred L. Whipple, "Recollections of Pre-Sputnik Days, in Ordway and Liebermann, Bluepritnt for Space, 129. Quoted in McCurdy, 38.
[1363] Ibid.
[1364] Ibid.

Space Frontier (1952) and *Conquest of the Moon* (1953). Von Braun, Ley, and many of the usual suspects contributed to these publications.[1365]

Collier's

After Cornelius Ryan returned to New York, he approached Ley and other spaceflight advocates. This coordination led to the first installment of an eight-part series of articles that promoted and lavishly illustrated the cause of space travel, often with the help of Chesley Bonestell. The first issue of appeared on March 22, 1952. The cover displayed a beautiful Bonestell rendition of a von Braun's winged rocket. The headline read, "Man Will Conquer Space Soon: Top Scientist Tell How in Startling Pages." In the issue, von Braun, Ley, Haber, Whipple, and Schacter contributed articles that projected optimism about the design and use of a space station.

A second installment of the series appeared in the fall. It focused on the "next step" from the space station to surface of the moon. The editors predicted, "We will go to the moon in the next 25 years."[1366] Von Braun wrote about the technicalities of the trip, while Ley explained the passenger rockets, along with a short description of the lunar base. Again, the issue was illustrated beautifully.

Six more space-related issues appeared throughout 1953 and 1954. They became more focused on the selection, training, and health of future astronauts. They also continued to outline the next steps in the cosmic journey, which culminated in von Braun's plans for a two-and-a-half year voyage to Mars. By this point, Ley became less involved with the *Collier's* issues. He did contribute to Ryan's edited volume, *The*

[1365] See Ward, *Dr. Space*, 87. Source quoted as: Fred L. Whipple, letter, March 2, 1972, "X + 60 and Counting."
[1366] Quoted in McCurdy, *Space and the American Imagination*, 40.

Conquest of the Moon. Nevertheless, by 1952, Ley had other passions that grew increasingly important. Ryan and von Braun grew to dominate the series. In many ways, *Collier's* reflects von Braun's entry into the media arena.

Although it was a crucial moment in the association of von Braun with the cause, along with the support of an influential magazine, the importance of *Collier's* can be overstated. In particular, Bob Ward argued that von Braun's work for *Collier's* was "the first major breakthrough in spreading the space gospel to the American people."[1367] Accordingly, the series "created a sensation."[1368] It is far more accurate to agree with Michael J. Neufeld, who argued, "It was a milestone in selling spaceflight and made von Braun's wheel the iconic space station for nearly two decades."[1369] Also, Cornelius Ryan later recalled, "I shall never forget the controversy that followed. We were both praised and damned…"[1370] The *Collier's* series was an influential milestone, and it marked an important moment of von Braun's appearance on the scene. However, if viewed from a much larger context of popular science, film, television, and print media, then *Collier's* was following a trend, more than it was breaking through. Certainly, much of the pre-existing media could be aimed at more juvenile audiences. If historians disregard the successful efforts of Ley, Pendray, Clarke, Asimov, and other science writers, then *Collier's* might be seen as the first moment when "serious" experts championed these ideas for an adult public. One might argue, as Neufeld has, that

[1367] Ward, *Dr. Space*, 87.
[1368] Ibid., 88.
[1369] Neufeld, *Von Braun*, 259.
[1370] Quoted in Ward, 88. Source listed as Milton W. Rosen, letter, February 16, 1972, "X + 60 and Counting." He also remembered the "vehemence of those critics" who considered von Braun's proposals to be far-fetched.

Collier's and other serious efforts were "slowly undoing the damage" caused by decades of ridiculous science-fiction.[1371]

Yet, perhaps there is a different way to view these issues, due to the emerging tensions of the scene. These issues stirred controversy, not only among the general public, but also within the growing community of advocates. By the time that Ley organized the second symposium in late 1952, tensions flared between von Braun's unrestrained optimism and the more "down-to-earth" approach of scientist Milton W. Rosen. Ley served as a mediator at times, according to Rosen. He later recalled, "Ley… wanted me to modify or withdraw my remarks in fear that they might do damage to the cause of space flight."[1372] Ley's motivations are unclear. Did he believe that a more "down-to-earth" approach would damage the cause? It is possible, considering that so many of Ley's publicity activities promoted space exploration on a grand scale. Above all, his work for *Tom Corbett* indicated that he had little quarrels with ambitious visions of cosmic exploration. Nevertheless, there was a line that Ley would not cross. If a concept became simply too far-fetched or unrestrained, then it entered into the realm of nonsense. He had spent much of his career debunking sensationalist, pseudoscientific, and pseudotechnological ideas. He criticized publications that played loose with the facts or strained the credibility of science or engineering.

In this case, it seems plausible that Ley grew to dislike the tactics of von Braun and Ryan, when it came to generating controversies that could damage the cause. While he continued to remain in the loop, as he also contributed to Ryan's edited collections,

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[1371] Neufeld, *Von Braun*, 252. It should be noted that *Collier's* was no stranger to controversy. In fact, a broader look at the history of the magazine indicates that it had been gravitating toward sensationalist "specials" and other exciting ideas for a decade.
[1372] Quoted in Ward, 89. Source: Milton W. Rosen, letter, February 16, 1972, "X + 60 and Counting."

he may have slowly disassociated himself from *Collier's* efforts, although he would go on to co-publish books with Wernher von Braun. Arguably, there was a deep tension between von Braun's efforts to generate controversies, grand visions of convoy trips to Mars, and other somewhat disingenuous efforts to excite the public. In Ley's perspective, von Braun and Ryan may have crossed the line. Regardless of his motivations, Ley seemed happy to witness the ascent of von Braun as America's prophet and popularizer. It freed Ley to branch out further.

Lands Beyond

In 1952, Rinehart publishing firm released a book that was jointly written by L. Sprague de Camp and Willy Ley. Although de Camp received top billing, the book originated from a rejected manuscript by Ley. De camp helped to revise the work into *Lands Beyond*.[1373] This book became Ley and de Camp's most celebrated collaboration, after it won the International Fantasy Award for nonfiction. It also displayed a shared interest that brought de Camp and Ley together, as two science writers deeply fascinated with myths, legends, and folklore. At the same time that they unleashed their curiosity about mythical or mythological "lands beyond," they reveled in scientific debunking. Thus, *Lands Beyond* combined a reverence for the mysteries of Nature with a heavy dose of skepticism.

The book begins by discussing the "three colossal figures" of human history: "the warrior, the wizard, and the wanderer."[1374] While the warrior protected "the folk"

[1373] L. Sprague de Camp and Willy Ley, *Lands Beyond* (New York: Rinehart, 1952). See also, "Strangest Myth of Pseudoscience," *Science Digest*, September 1953, 80-83.
[1374] Ibid., 3. All subsequent quotes prior to the block quote can be found on this page.

from "material foes," the wizard protected the people from "supernatural dangers."[1375] Meanwhile, the wanderer fueled the popular imagination by bringing both "goods to trade and news of far and fantastic places to entertain." Here, de Camp's materialism rears its head: "In competing for prestige and power, all of these public figures are wont to make much of their importance and to magnify the perils and hardships of their occupations." Each group had a vested interest in exaggeration, along with an inherent disinterest in objective truths about people, places, and nature. Granted, there are limitations placed upon the stories of the warrior and wizard. They are restrained by the presence of witnesses, who might dispute the most far-fetched aspects of their tales. However, the traveler "has a virtual *carte blanche*." The authors argue:

> No wonder 'traveler's tale' has come to mean an elaborate lie or fantastic exaggeration! And one traveler's tale paves the way for the next, for when one is brought up to believe that beyond the horizon lie the perilous seas of faery lands forlorn, infested by demons, dragons, and men whose heads do grow beneath their shoulders, a tale that confirms this belief will find readier acceptance than one that refutes it.[1376]

In spinning these tales, the traveler combined "the brawn and agility of the warrior with the guile and glibness of the wizard, in order to repel assault, to flee catastrophe, and to ingratiate himself with strangers…"[1377] De Camp and Ley added: "Courage and resource he needed, but strict truthfulness he would find more a handicap than an asset." Despite this knack for deception, the traveler was still an admirable figure, because he possessed "a burning curiosity as to what lay beyond the horizon." He suppressed "his atavistic fears" to seek out new lands and to discover whether those lands beyond were places "of heavenly delight or of hellish horror." The act of exploration took a

[1375] Ibid.
[1376] Ibid., 3-4.
[1377] Ibid., 4. Subsequent quotes in this paragraph are found on page 4.

tremendous amount of courage. It included a large amount of unknown risks, which is why the traveler stood above the warrior and the wizard.

The warrior faced "a known danger."[1378] Likewise, "the magician dealt with dangers which, while unknown to the masses, were presumably known to him, and on his own ground."[1379] However, "the traveler faced perils unknown even to him: devouring monsters, fierce people not altogether human, and the wrath of strange gods." He also faced the threats of nature. Having proven himself as a fearless explorer, "he did not understate the dangers he had undergone." Instead, "by making the most of them… he could expand his ego, justify the high prices he wanted for his trade goods, and discourage possible competitors from horning in on his territory."

Nevertheless, these tales "were seldom pure fabrications."[1380] Indeed, it was far easier to exaggerate the real than to imagine the fake. The early travelers' tales created "a series of half-mythical worlds somewhere in the dimly known lands beyond the horizon of reality, in a belt surrounding the known."[1381] One of the main tasks of *Lands Beyond* included the untangling of the real from the fake, while simultaneously appreciating how cultural beliefs and folklore shaped an imperfect understanding of the world. One might expect the authors to openly celebrate the triumph of modern science, after scientific expeditions finally dispelled myths and legends. In some ways, the authors do just that, arguing, "at last the search for scientific fact filled in our knowledge of the world so that hardly any part of it is really unknown any more."[1382] They continued: "In the process the worlds of geographical legend, after having been

[1378] Ibid., 4.
[1379] Ibid., 5. Subsequent quotes in this paragraph are found on page 5.
[1380] Ibid.
[1381] Ibid., 6.
[1382] Ibid., 7.

whittled down and shunted all over the map, have finally been pushed off the globe altogether."[1383] Modern science triumphed over myths, superstitions, and legends.

However, the purpose of the book did not simply involve debunking the fake. In fact, de Camp and Ley attempted a "restoration" of ancient and medieval worldviews. They tried to put those worldviews in a cultural and historical context. In some cases, this task was impossible when all that survived were "fragments—tantalizing glimpses—which we cannot restore to coherent wholes because key pieces are missing."[1384] Nevertheless, the endeavor was systematic and similar to paleontology: "Still, as we can restore a dinosaur from its bones, so can we re-create these imaginary worlds from their traces in literature, folklore, and figures of speech. And a fascinating business it is."[1385] Not only was it possible "to write the story of exploration from the point of view of who discovered what and when," but it was also possible "to write the same story from the point of view of what people wanted or hoped to find."[1386] The history of myths and legends thus represented a history of human aspirations and fears. Although modern man can rest assured that the world had been purged of demons and monsters, he could still take a moment to appreciate how those pre-modern beliefs represented a vast degree of human creativity, curiosity, and humility before the mysteries of Nature.

Each chapter of the book explored these themes by simultaneously debunking legends while celebrating their creation and circulation. Arguably, different chapters can be attributed to each author's specialized interests. For example, Ley's perspectives

[1383] Ibid.
[1384] Ibid.
[1385] Ibid., 7
[1386] Ibid., 7-8.

can be read in the first chapter, titled "The Land of Longing." It is perhaps his most forceful and entertaining debunking of Atlantis. He delights in discrediting "careless… investigators, negligent in their logic, and given to believing whatever pleased them."[1387] These pseudoscientists and cultists clung to certain hoaxes "of the baldest kind… even after it was exposed."[1388] Much of the history of theories surrounding Atlantis included "logical slips so conspicuous that only hopeless credophiles could swallow it."[1389] In many ways, the search for Atlantis had now become a practice of cranks and "occultists who… pushed their way into the lost-continent domain."[1390] In the end, the field was a complete mess of contradictions and assumptions: "It seems, and actually is, impossible to make any sense out of such an enormous accumulation of supposition, commentary, cross-and counter-commentary and piled-on private beliefs and prejudices."[1391]

For Ley, the question was simple. In order to solve the mystery, a rational person had to return to the only reliable primary source, which was Plato's *Timaios*. Ley argued: "When we turn back to Plato himself we find that most of the perplexities just disappear; after the occult horror chambers of black magic and primal races the actual reading of the Timaios is like a pleasant breeze from the sea on a sunny day in the company of rational people."[1392] Atlantis was simply a literary device used by a philosopher who was "(to our mind) careless with the use of facts."[1393] "Since he wanted to express abstract ideas," Ley added, " he did not handle facts with precision;

[1387] Ibid., 17-18.
[1388] Ibid., 18.
[1389] Ibid.
[1390] Ibid., 19.
[1391] Ibid., 22.
[1392] Ibid.
[1393] Ibid., 24.

the ideas did not depend on these particular facts, so there was no need for exactness."[1394] In spite of Plato's flaws, the original story could still be appreciated for what it revealed about the Greek context. The original story is priceless compared to the "spilled" ink that produced a cottage industry of baseless speculations.[1395] It revealed Greek literary devices, the political theories of an ancient philosopher, the circulation of Babylonian beliefs in catastrophe, and other historical gems. Ley concluded: "But the continent of Atlantis would never have appeared on any map of the real world, no matter when drawn."[1396]

Other chapters display a similar love of debunking. From the locations in works of Homer and "the fabulous East," to other "masterpieces of literary larceny," de Camp and Ley unmask the lapses of logic, the unscientific reasoning, and the downright charlatanism of various psuedoscientists.[1397] De Camp and Ley even take on sacred legends of religious significance, such as the Christian kingdom of "Prestor John" and the Jewish kingdom of the Ten Lost Tribes. In the case of the latter, "[W]hat started out as a purely historical problem—and, at times, as a hope for Jews living elsewhere—later degenerated into one of the wildest sleeveless errands in the story of strange quests."[1398] These "lands beyond" only existed in "the cult mind."[1399] Again and again, each of these legends could be boiled down to a simple historical context surrounding a primary text. Often, the easiest explanation was most valid. "For a tribe to disappear

[1394] Ibid.
[1395] Ibid., 26.
[1396] Ibid., 43.
[1397] Ibid., 113.
[1398] Ibid., 159.
[1399] Ibid., 171.

under stress of war and migration," the authors argue, "is the most natural thing in the world."[1400]

In the end, these tales could still be appreciated for what they revealed about the historical context, as well as human longings and hopes for alternative worlds. The book's epilogue even laments the fact that none exist: "Indubitably these imaginary landscapes were more brightly colored, livelier, and more romantic than the real thing. It's a little sad that they do not exist in fact…"[1401] Yet, if they had been discovered, they would have become everyday facts, instead of cultist mysteries that invite scientific scrutiny. "So," the authors conclude, "perhaps it is better that these things exist only in print. That way they afford enjoyment of the mental pictures they evoke and provide the pleasure of tracing down their histories to see how they came to be."[1402]

Lands Beyond became an instant hit for both Ley and de Camp. Reviewers praised the book's style and content. In the *New York Times*, Charles Poore wrote, "Mr. Ley and Mr. De Camp rush up and down time's aeons [sic] with astonishing assurance… I traveled enjoyably with them… only wishing, occasionally, that they were not quite so cocksure."[1403] Poore further praised the authors' celebrations of "modern investigation [which] has put an end to all the beguiling moonshine."[1404] Nevertheless, a sense of loss could be felt, as the lands beyond "vanished, with so many other good stories."[1405] Poore then looked to future by reviewing Arthur C. Clarke's *The Exploration of Space*. He argued that "a spirit of superbly controlled wonder" animates

[1400] Ibid., 177.
[1401] Ibid., 320.
[1402] Ibid., 321.
[1403] Charles Poore, "Books of The Times," *NYT*, June 19, 1952, 25.
[1404] Ibid.
[1405] Ibid.

the text, making it a fit well with Ley's other works. "It is a challenging link between the lost Atlantis and the unvisited geography of the stars."[1406]

Other reviewers noted how *Lands Beyond* complemented Ley's other books on space travel. "What Willy Ley and his collaborator have done here," wrote Michael Amrine, "is very similar to Mr. Ley's book of folklore and fact on space travel… "[1407] Whereas *The Conquest of Space* excited readers to imagine the exploration of great unknowns, *Lands Beyond* "re-creates in wonderful style the mental atmosphere of the Age of Exploration. It gives readers first-hand glimpses of the exploits of navigators… it quickens one's pulse with the desire to put to sea on those same voyages."[1408] In the words of a different reviewer, "readers ride to mythical destinations."[1409] Yet another reviewer noted the theatricality of such a mental exercise: "Well, step right up, ladies and gentlemen, and meet the wonders of 'Lands Beyond.'"[1410] The journey was wondrous.

The Great Gig of Galaxy

In the summer of 1952, Ley signed an exclusive contract to serve as "science editor" for *Galaxy*, a new science fiction pulp that premiered in 1950. Whereas earlier

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[1406] Charles Poore, "Books of The Times," *NYT*, June 21, 1953, 13.
[1407] Michael Amrine, "Those Cities of Gold," *NYT*, June 22, 1952. BR6.
[1408] Ibid.
[1409] "Readers Ride To Mythical Destinations," *Ft. Wayne, Ind. News-Sentinel*, June 21, 1952, page number not found on clipping in the WLC.
[1410] "Ruth D. Ray, "Far Away Lands," *Hartford Conn. Courant*, July 6, 1952. This reviewer is more critical of de Camp and Ley's style. Ray writes, "'Lands Beyond' is interesting in spite of the authors, who approach a fascinating subject in such a matter of fact, prosaic way that the reader sometimes gets the idea that Mr. Decamp and Mr. Ley are writing a term paper on what to them must be a boring subject." This is a bizarre review, given the style of the book. Other reviews include: Joan Stanford Bishop, "Man's Cupidities and Dreams in Mythology of Geography," *Bridgeport, Conn. Post*, July 13, 1952; Glenn Negley, "Wily Wilds," *Saturday Review of Literature*, July 26, 1952, page number missing in a clipping in the Willy Ley Collection.

magazines like Campbell's *Astounding* forced the science writers to compete for space, *Galaxy* wanted a consistent and regular expert on "science fact." This also fit well with editor H. L. Gold's (and then Frederik Pohl's) desire to make the magazine far more respectable than an earlier generation of pulps. Not only would *Galaxy* stick to the scientifically plausible, but it would also focus on social issues, rather than Gernsbackian technophilia. While other pulps could endorse pseudoscientific concepts, such as Campbell's embrace L. Ron Hubbard's "Dianetics," *Galaxy* would try to avoid such "nonsense." It also paid writers better, which attracted quality stories. Eventually, *Galaxy* would publish some of the most notable works by Ray Bradbury, Robert Heinlein, and many other legendary writers of the "Golden Age."

Initially, *Galaxy*'s contract was generous. *Galaxy* paid Ley $100 a month to write a "For Your Information" article on science fact. The terms of this agreement required that Ley sever all connections and ties to competing publications.[1411] As Ley interpreted this clause, he could not write for *Astounding* or other pulps. In exchange for that restriction, he would earn a regular income for a few days of work per month. This arrangement was a small part of a more lucrative five-year contract. Ley agreed to supervise *Galaxy*'s radio and television programs. He would have full creative control over "the preparation, development, writing and arrangement of the subject matter, plot and story…" Additionally, he would appear weekly as a "performer" in the radio studio of WJZ in New York City. For fifteen minutes a week, Ley hosted "Looking into Space." *Galaxy* agreed to pay Ley $75.00 for every weekly broadcast. He could also earn 50% of any net profits from the broadcasts. In return, Ley agreed not to appear on

[1411] *Galaxy* Publishing Corp. contract, July 1, 1952, Willy Ley Collection. The specific clause stated, "You shall not write any stories or material of any kind or authorize the use of any of your writings by any other publication, directly competing with GALAXY without our prior consent."

"any other radio or television program" without the prior consent of *Galaxy*. Ley amended this clause to allow for book promotions. By this arrangement, Ley could earn over $400 a month by writing a short article, spending an hour per month on the air, and serving as a general science editor. It is unclear whether his duties included vetting the content of science fiction stories. Also, the contract said nothing about Ley's responsibility to respond to fan mail, which would become an issue. Thus, the arrangement with *Galaxy* began as a very positive experience for Ley. Yet, one day after signing the contract, President Robert Guinn tried to amend the terms to alter Ley's supervision of any programs "where we will not require your services." Ley may or may not have agreed to this alteration. He kept an unsigned copy in his personal files, which could indicate that he simply refused.

Despite this initial revision, Ley greatly enjoyed his early association with the publication, in spite of an announcement for readers to "Send you science questions to Willy Ley c/o Galaxy. He'll answer them all by mail or in this department [column]. Keep them short, a few at a time, and print or type them, please!"[1412] His earliest contributions included articles on astronomical subjects such as meteors or the question of "When will World's Collide?"[1413] Ley used this article to poke fun at the publicity surround George Pal's new film, *When Worlds Collide*, and its loose connection to Immanuel Velikovsky. Ley wrote, "If one has to worry about something, there are more urgent problems than the possibility of cosmic collision."[1414]

One of Ley's top-billed articles was titled "Space Travel by 1960." The cover showed an enlarged V-2 inspired rocket, ready to launch to the moon. Ley commented

[1412] See "For Your Information," *Galaxy*, September 1952, 49-59.
[1413] Willy Ley, "When will World's Collide?" *Galaxy*, July 1952, 75-82.
[1414] Ibid.

on the progress of the last three years: "This issue's cover is something of 'instant recognition' to science fiction readers… [who] would have recognized such a picture even twenty years ago. Now, however, the same picture might be on the cover of any magazine and the majority of the readers of that magazine would know what it is supposed to show."[1415] Ley added: "That is vast progress."[1416] This article ended with an "Any Questions?" section. Ley answered a question about the natural causes of glacial melt. Then, he responded to a different question by making the reader do the math. This type of direct reader interaction would continue intermittently throughout Ley's tenure as *Galaxy*'s science editor. With his presence as the scientific expert of the pulp "backyard" of letters and reader reactions, Ley promoted a "participatory culture" that had become a staple of the genre.[1417]

In the next issue, Ley moved away from space travel into the realm of general predictions. Again, *Galaxy* used the cover to illustrate "The World of October 2052."[1418] It included a fashionable dinner party with robots and aliens. Despite the fantastic cover, some of Ley's predictions were fairly conservative. For example, Ley did not believe "that the day of printed word has almost reached its end." Books would continue to be physical things, ready to be leafed through. Ley also doubted the reliability of the "electronic device" that might someday replace newspapers. He also viewed large cities and public transportation as the norm of the future, in spite of the threat of atomic warfare. There was also one device that was entirely plausible: the answering machine.

[1415] Willy Ley, "Space Travel by 1960," *Galaxy*, September 1952, 90-91.
[1416] Ibid., 91.
[1417] Cheng, *Astounding Wonder*, 77.
[1418] Willy Ley, "The World of October 2052," *Galaxy*, October 1952, 81-93.

He would write similar articles for *Galaxy* for the rest of his life.[1419] Soon, his articles for *Galaxy* were reaching an expanding audience of dreamers. As *Galaxy* offered speculative fiction about the future, Ley steered the reader's imagination in the right direction with articles like "The Birth of the Space Station," "Mail by Rocket," and "The How of Space Travel."[1420] He quickly embraced the role of a general expert on all things scientific. Most likely, Ley enjoyed how *Galaxy* promoted his role and his expertise. For example, in the April 1953 issue, the editor announced: "Science had become so complex and confusing, even to scientists, that there must be some question that you'd like Willy Ley to explain clearly, authoritatively, and in everyday English."[1421] The piece continued, "As you can see for yourself, he's an expert in clarification… It should also be apparent that he is not a scientific snob.—For Your Information is run for the benefit of laymen, not scientists—so there's no reason to be ashamed to ask any question in his field."[1422] Again, the editors insisted that Ley would answer every question by mail, if it was not printed in the magazine. It added, "Now… what was it you wanted to know?"[1423]

From this point on, letters swamped Ley. He responded to as many as he could. Yet, the workload quickly became unmanageable. Nevertheless, he would answer readers' questions about all manners of scientific matters. Many of the questions related

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[1419] Quite often, Ley gave readers updates regarding his most recent lecture tours. Over time, he included more personal details.
[1420] For space-related articles during these years, see Willy Ley, "Space Travel by 1960?" *Galaxy*, September 1952; "Mars," November 1952; "The Birth of the Space Station," parts one and two, April and May 1953; "Second Trip to Venus," July 1953; "The 'Martian Space Stations'," September 1953; "Small Bodies Near Heavy Planets," January 1954; "Close-up of Mars," July 1954; "Mail By Rocket," August 1954; "Asteroid Round-Up," November 1954; "Death of the Sun," parts one and two, March and April 1955; "The Orbital (Unmanned) Satellite Vehicle," July 1955; "Unveiling the Mystery Planet," September 1955; "The How of Space Travel," October 1955.
[1421] "Any Questions?" *Galaxy*, April 1953, 63.
[1422] Ibid.
[1423] Ibid.

to space travel and rockets. Or, the readers asked general questions about Einstein's theory of relativity, the Hydrogen bomb, and human evolution. For many of these questions, Ley simply went through the motions, answering these inquiries as best he could. At other times, he delighted in answering more general questions, particularly when they came from curious girls and mothers who were interested in natural history. He even helped one reader build a modern version of an ancient chariot.

Although *Galaxy* catered its content to science fiction readers, Ley used every opportunity to teach them about wondrous creatures, astonishing legends, and amazing historical facts. He made many readers feel good for asking some basic questions about science, both past and future. He encouraged their participation. He used *Galaxy* to promote science as open to every inquisitive amateur and hobbyist.

Disney in Space

When *Collier's* space-themed series ended in the spring of 1954, a greater opportunity arose, particularly for Ley and von Braun. While some Hollywood brokers continued to resist the medium of television, Walt Disney embraced the genre by agreeing to produce weekly television programs for ABC. Disney had several motivations. Foremost, he sought to produce a program that promoted and financed the construction of Disneyland in Anaheim, California. The television programs were organized according to the park's four themes: "Adventureland," "Frontierland," "Fantasyland," and "Tomorrowland." As Howard E. McCurdy notes, "Of the four

themes, Tomorrowland was the least developed."[1424] Consequently, Disney tasked senior animator Ward Kimball to develop ideas for futuristic television specials that might attract American families. Like many Americans, Kimball had followed the space-themed issues of *Collier's*. According to some accounts, Kimball was greatly impressed that "there were reputable scientists who actually believed that we were going out in space."[1425] He first called Ley to contribute.[1426] Ley eventually recruited von Braun and Haber. Together, these "space boosters" would gain access to an audience of millions.[1427]

Ley recalled, "The telephone operator told me that Burbank, California, was on the line, and then a male voice asked how soon I could be there, 'Walt Disney calling.'"[1428] Ley left as soon as possible, spending three days at Walt Disney studios, where he learned of Disney's plan to produce a special television show (on film), which would also be released to movie theaters. It was titled *Man in Space*, with an ABC broadcast date in March of 1955. Most accounts indicate that Ward Kimball got the ball rolling, while Disney thought in broader strokes surrounding a way to help finance the construction of his theme park. Not only would the television show supply profit, but also it would help gain exposure for Walt Disney as a public educator. Bringing science to the people was a central goal of Disney.[1429]

[1424] McCurdy, *Space and the American Imagination*, 41.
[1425] Quoted in McCurdy, 41. Source: David R. Smith, "They're Following Our Script: Walt Disney's Trip to Tomorrowland," *Future*, May 1978, 55.
[1426] Ibid., 41.
[1427] Ibid.
[1428] Ley, *Rockets* (1957), 331.
[1429] Indeed, there is an immense scholarly opportunity to revise historical accounts of Walt Disney and Disneyland. Typically, scholars have struck a critical tone, analyzing sites of corporate redesigns of traditional and vernacular space. Or, they have viewed theme parks as exemplars of capitalist, corporate culture. For an interesting review of this historiography, as well as potential guide for future studies, see

McCurdy summarized: "To assist with the show's story lines, Kimball called in Willy Ley, who in turn recruited von Braun and Heinz Haber."[1430] As Neufeld discovered, von Braun was quite reluctant to participate in Disney's adventure. He had competing arrangements with a Beverly Hills producer, and initially he turned the offer down. Neufeld explained: "Disney did not give up so easily, largely because Willy Ley was its first hire and he kept von Braun's name on the agenda as the ultimate salesman and idea man for spaceflight."[1431] Eventually, von Braun severed his ties to the competing producer, and the "Disney deal was on."[1432] He did not arrive in Burbank until July 10th, nearly three months after Ley had been contracted.

The most detailed secondary account of Ley's consulting activities can be found in an article written by David R. Smith, published for *Future* in 1978. In "They're Following Our Script: Walt Disney's Trip to Tomorrowland," Smith offers tantalizing clues from within the Disney Archives.[1433] According to this account, Disney was rather clueless about what to do with the "Tomorrowland" component of both the "Disneyland" television shows and the futuristic part of the theme park. Because Ward Kimball had a reputation as "the world's first hippie," Disney approached him and his assistants, allegedly saying in a snide tone, "You guys are modern thinkers around here… can you think of anything we can do on Tomorrowland?"[1434] Kimball recalled, "And that's when I said I had been following some very interesting articles about space in *Collier's Magazine*. It was really fascinating for me to realize that there were these

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Susan G. Davis, *Spectacular Nature: Corporate Culture and the Sea World Experience* (Berkeley, Los Angeles, and London: University of California Press, 1997).
[1430] McCurdy, *Space and the American Imagination*, 47.
[1431] Neufeld, *Von Braun*, 286.
[1432] Ibid.
[1433] David R. Smith, "They're Following Our Script," *Future*, May 1978: 54-62. Disney Image Licensing denied research access for this dissertation.
[1434] Ibid., 55.

reputable scientists who actually believed that we were going out in space."[1435] In Kimball's view, the articles showcased "von Braun's rockets and Ley's space stations," as illustrated by Bonestell.

A partial transcript of an April 17th conference with the team and Disney reveals an attempt to blend comedy and "serious" scientific facts, in a way that entertained and educated. Disney was cautious about fully mixing the two goals: "We should be careful and keep our serious stuff separate. We have to watch it so the material doesn't get corny."[1436] As a result of the competing interests between humor and scientific education, the format of the show ran as follows: An entertaining and comedic cartoon would present the history of the idea, while a middle portion would present the sober facts, as told by experts. This portion was followed by another humorous, yet educational cartoon about weightlessness. The show culminated in a serious, yet adventurous animated sequence of a trip around the moon.

Disney was enthusiastic. Allegedly, he tore off a blank piece of paper, handed it to Kimball, and said, "Write your own ticket."[1437] Suddenly, Kimball realized, "The key to his whole plan was the need to bring in prominent scientific advisors." When Kimball aimed his sights on the "qualified experts" in *Collier's*, he called Ley first. Ley had to postpone the trip for three days, in order to attend a *Herald Tribune* cocktail party in honor of his latest book.[1438] Then, he flew to Chicago and boarded an overnight flight for California. In a later issue of *Galaxy*, Ley recalled the scene: "When I sat in

[1435] Ibid.
[1436] Ibid., 56.
[1437] Ibid.
[1438] Ley's personal memories of this episode can be found in Willy Ley, "The How of Space Travel," *Galaxy*, October 1955, 60-71.

the beautiful air-conditioned studios… I mentally weighed the problems involved."[1439] Whereas an author could assume some degree of education among readers who spend money on a book, a television writer had different considerations. Ley mused, "Obviously everything had to be explained right from scratch."[1440] He added: "On the other hand, the most instructive device invented so far was at our disposal: the animated cartoon. We would not have to *explain* with words, as I do in lectures; we could *show* how things work. As a means of visual instruction, this was superior even to film."[1441] After Ward Kimball explained Disney's storyboard process, Ley contributed to the initial "idea" of a program that explained the astronomical basics, traced the history of space travel in literature, and introduced viewers to the ideas of scientific experts. The show would climax with a rocket flight to the Moon or Mars.

Two week later, Ley returned to sign a contract and begin work on the project.[1442] Smith described the scene as Ley had many meetings with different teams: "The men were fascinated with Willy Ley. Despite the odorous cigars that he chain-smoked, they gathered around him and hoped that some of his knowledge would rub off on them."[1443] An assistant recalled:

> Willy was a real encyclopedia. He had information on just about anything you wanted. If you asked him a question, he'd pause for a second, then he'd say in his music hall German accent, "Vell, as a matter of fact," and then he'd take off with an encyclopedic description of whatever it was you were asking him. He was a very amusing fellow; we all got a big kick out of him.[1444]

[1439] Ibid., 62.
[1440] Ibid., 63.
[1441] Ibid.
[1442] In Ley's version of events, he stated, "I was there three days later," after the phone call. See *Rockets* (1957), 331. Smith states, "Within two weeks after the initial April meeting, Ley arrived…" Smith, 56. On the contract, see Smith, 57.
[1443] Smith, "They're Following Our Script," 56.
[1444] Ibid.

According to this account, Ley repeatedly insisted that "planned flights could be done immediately, that no additional discoveries were needed, just money and motivation."[1445]

After several days of meetings with Ley, the producers agreed that there was simply too much material for a single show. They decided to make a two-part "cliff hanger," with the first part culminating in a trip to the moon, while the second part explored the space station and Mars. For his part, Walt Disney did not oversee many elements of the production. He was too busy with designs for Disneyland. However, on May 14th, he made his intentions clear during a meeting, in which he said: "We are known for fantasy, but with these same tools that we use here we apply it to the facts and give a presentation. I think that's very important for this series—a science factual presentation."[1446] Disney also commented as to how the combination of experts and dreamers was "the key for the whole series."[1447] It would be exciting for the audience to see men "dealing with fantasy and men dealing with fact come together, meeting and combining their resources…"[1448]

After von Braun and Heinz Haber became more involved, many of the details changed. In retrospect, Ley recalled: "I don't know just what had been expected of the experts before they arrived; what we did do was to turn offices and sketch rooms into classrooms and apparently everybody was very pleased."[1449] Throughout the months of June and July, Ley continued to make trips to Disney. Most likely, at this point his consulting role expanded to Disneyland itself, as engineers brainstormed the exhibits of

[1445] Ibid.
[1446] Ibid.
[1447] Ibid., 57.
[1448] Ibid.
[1449] Ley, "The How of Space Travel," 64.

"Tomorrowland," which would include a virtual rocket trip to the moon and a space station that families could tour, while looking down about the earth, through large windows. Ley's exact role in helping to design these exhibits is unknown. Evidence, however, suggests that he was in high demand. Both the television show and at least some aspects of the futuristic theme park were inspired by his designs and also influenced by the many exhibits of the 1939 World's Fair.

Engineers' Dreams

By 1954, Ley had already done so much to advocate for large-scale investments in rocketry and spaceflight technologies. He championed the crusade by popularizing scientific concepts, technological imagery, and narrative tropes surrounding the imminent conquest of space. These years marked the peak of Ley's celebrity status as America's authority on rockets and space travel. According to friend and fellow science writer Isaac Asimov, Ley, "more than anyone else, prepared the climate within the United States for the space effort."[1450] Thus, it may seem odd that Ley devoted several months to a book, in which he wrote, "I am well aware of the fact that I haven't said a word about space travel…"[1451] He claimed that he avoided the topic for the simple reason of writing so much about it elsewhere. Although the book has nothing to say about space travel, it reveals so much about Ley's perspective of the need for massive investment in large-scale technological feats.

[1450] Quoted in Henry Petroski, "Engineers' Dreams," *American Scientist* 85 (July-August 1997): 310. Original source listed as Isaac Asimov, *Asimov's Biographical Encyclopedia of Science and Technology* (Garden City, NY: Doubleday, 1982).
[1451] Willy Ley, *Engineers' Dreams* (New York: Viking, 1951), 271, 1964 edition.

In this book, titled *Engineers' Dreams*, Ley outlined the histories of "great projects that could come true." Key examples included a "forbidden tunnel" linking Great Britain and France, the creation of massive lakes in Africa, and proposed efforts to create "Atlantropa" by damming and partially draining the Mediterranean Sea. By tracing the histories of these projects and their heroic planners, the book celebrated human ingenuity in the face of natural and political obstacles. The theme of the book was simple: these grand and expensive engineering projects were perfectly sane and reasonable. Yet, they required international cooperation, which demanded that politicians get out of the way of engineers.

Ley argued, "Engineers' Dreams are things that can be done—as far as the engineer is concerned. They are also things that cannot be done—for reasons that having nothing to do with engineering."[1452] Often, these projects are impossible because the "sums involved may be so huge that only government could pay them." Convincing commercial interests to invest became an uphill struggle, particularly because the schemes required large initial investments, while offering long-term returns. However, the main culprits are "political difficulties." When an engineer's blueprint crossed the political boundaries of nation states, the project either died or became buried in "a mountain of paperwork." While the engineering difficulties could be easily overcome, the political troubles brought "too many highly uncertain factors."

Consequently, Ley could not predict the future of these engineering visions "because these factors are so uncertain they may shift around and all of a sudden favor something which was formerly politically impossible, or economically impracticable, or

[1452] Ibid., 11. Subsequent quotes in this paragraph are found on page 11.

even thought to be obsolete."[1453] These projects could be realized, yet "what *will* happen must be left to the future."[1454] In the past, many of these projects were considered "fantastic." By the twentieth century, almost anything was possible. In fact, "the word fantastic, when applied to engineering, merely means 'it has not yet been done.'"[1455] Ley displayed an enormous amount of optimism surrounding future accomplishments. For example, it was "possible, in principle, to tap the heat of the earth's interior," thereby unleashing "an enormous untapped reservoir of power in the earth."[1456] Ley added, "The comforting fact is that the energy is there. If we need it, we'll find ways and means of going after it."[1457] Likewise, engineers knew that "a literally inexhaustible source of energy… comes every day, year after year, from the sun. All they had to do was to find a way to trap and harness it."[1458]

Other projects were equally plausible and ambitious. For example, if the nations of Africa would put aside political differences, it would be possible to flood the Sahara Desert by constructing a massive canal to the Atlantic Ocean. "In the end," Ley argued, "instead of a hostile desert you would have a large and navigable body of water."[1459] Regarding the native Africans in those territories, Ley was optimistic:

> That the drowned area is an especially unhealthy place is generally conceded, but it is the home of a large number of Africans, about two million, who would have to be moved. Since the property of these Africans is mainly portable property, since the change would come about rather slowly, and, most important, since the move would certainly better their living conditions, it is unlikely that they would object. Moreover, since they are now independent, the

[1453] Ibid., 11-12.
[1454] Ibid., 12.
[1455] Ibid., 16.
[1456] Ibid., 90-92.
[1457] Ibid., 93.
[1458] Ibid., 162.
[1459] Ibid., 124.

> order to move would no longer come from a European power (whose intentions may be disbelieved) but from their own government.[1460]

Ley also expressed confidence in the benefits of damming the Strait of Gibraltar and partially draining the Mediterranean: "The final result would be 220,000 square miles of new land and hydroelectric power plants of virtually unlimited capacity…"[1461] Standing in the way of progress was "the political situation of today [that] makes the engineering problems future problems, and we can't tell how an engineer 50 years from now would go about solving them."[1462] Nevertheless, it was entirely possible if "a united Europe is a reality and… the control of the Strait of Gibraltar has developed into a purely commercial problem, with all military aspects absolutely missing."[1463]

It is easy to view these ideas as examples of mid-twentieth-century modernization theories. They promoted the violent redesign of nature, with little anticipation of unforeseen consequences. Overall, the natural landscape and the resources of the earth are viewed as tools, ready for conquest and upheaval. As a later reviewer recalled: "Ley's recounting of a cost-benefit analysis betrays the insensitivity of his times to issues that today evoke knee-jerk reactions, even when the projects are minuscule and innocuous in comparison to the damming of the Congo River."[1464] Overall, the book illustrated Ley's modernism. Despite his self-described romantic naturalism, he tended to view the earth in terms of grand redesigns and the forceful conquest of nature.

[1460] Ibid., 135.
[1461] Ibid., 148.
[1462] Ibid., 153.
[1463] Ibid., 153.
[1464] Henry Petroski, "Engineers' Dreams," 312.

Despite the insensitivities, historians should recognize the more positive hopes that underpinned these grand visions. That these projects would benefit all became a central component of an engineer's dreams. Like other modernists, Ley was overtly confident that Western minds and modern technologies could reshape the world. These projects would be acts of creative destruction, similar to the building of a World's Fair. After the initial destruction, humanity, as a whole, would benefit from unlimited sources of energy, the creation of new lands, and more effective means of transportation. At times, Ley implies that all of these factors will help to eliminate war, nationalism, and poverty. Engineers could save the world, if the social and political factors would adapt to the needs of engineers. It was high time for politics to get out of the way.

Still More Adventures of a Romantic Naturalist

At the same time that Ley promoted modernist fantasies of redesign, he continued to refer to himself as a "romantic naturalist." In 1955, he published the "Third Lungfish," titled *Salamanders and Other Wonders: Still More Adventures of a Romantic Naturalist*.[1465] It followed in the footsteps of *Lungfish* and *Dragons*. Ley recalled, "I had set out to assemble the case histories of several species that came close to extinction in our time—some even being reported as extinct—but managed to survive, sometimes with the aid of man."[1466] With the vigilance of a detective, Ley also "set out to find, if possible, the truth behind a few wild stories which are vaguely known

[1465] Willy Ley, *Salamanders and Other Wonders: Still More Adventures of a Romantic Naturalism* (New York: Viking, 1955).
[1466] Ibid., x.

to every naturalist (and are most decidedly known to be ridiculous)."[1467] He similarly investigated the "stories behind some facts about which there was a noticeable amount of controversy.."[1468] "Let's find out what can be found," he stated.

The book documents Ley's fascination with nature, its explorers, and the tales of native witnesses. Nature's curiosities ranged from "the abominable snowman," to "the man-eating tree of Madagascar." As one would expect, Ley spends much time debunking ridiculous ideas. Yet, at other times, Ley shows a remarkable curiosity and tolerance for the zoological mysteries of nature. For example, he begins the chapter on the "abominable snowman" by stating, "Somewhere in the high valleys to the north of India… there is something unknown, or, at the very least, something unexplained. What evidence there is consists mainly of footprints."[1469] Ley then traces the history of eyewitness accounts. Often, he leaves it up to the reader to judge the credibility of a statement. He is careful to state that the evidence is not definitive. Yet, he concludes with an optimistic statement about the yeti: "No matter whether Asia or Africa is finally acclaimed as the continent where humankind was born, the facts are that very primitive humans, sub-humans, and near-human creatures lived on both continents. And if a near-human and very primitive race shared the fate of the panda and the langur, its survivors would fit the description of the yeti perfectly."[1470]

Ley could be associated with other "crypto-zoologists." He firmly shared in the belief that there must be a basis for eyewitness accounts of the "marvelous." These eyewitness accounts had their place in the history of science and exploration. In fact, the

[1467] Ibid.
[1468] Ibid.
[1469] Ibid., 93.
[1470] Ibid., 107.

very essence of naturalism involved a quest to document and explain the mysteries and legends. Ley makes a direct analogy between these zoological quests and past discoveries: "Marvelous were the things that early travelers returning from the American tropics had to tell to their relatives and neighbors… Incredible were the sights they had seen… doubts were in time crushed by evidence."[1471] Simply put, the history of science included case study after case study, in which the explorer confronted baffling stories or evidence of strange creatures. Many explorers discovered wondrous creatures that should be extinct. "In short," Ley explains, "it happened so often that a tale, though exceedingly strange on the face of it, was proved to be true, that nobody, on the strength of reasoning and logic alone, could hope to discover an occasional falsehood."[1472] Ley is careful to dismiss certain rumors, when there is a legitimate explanation. For example, the legendary "tree of death" near a volcano is attributed to the concentration of carbon dioxide. In other cases, such as the "man-eating tree of Madagascar," Ley writes, "The facts are pretty clear. Of course the man-eating tree does not exist."[1473] Yet, time after time, men of science have been confronted by evidence of a creature that managed "to survive through centuries when nobody knew that it even existed."[1474] For Ley, the naturalist must possess an open mind, along with a restrained humility in the face of complexity of nature and the adaptability of species. To make a definitive claim about the unknown was a preposterous and ignorant exercise.

Of all of Ley's adventures as a romantic naturalist, *Salamanders* was the most widely read and critically praised. It reached broad audiences from scholars to

[1471] Ibid., 147.
[1472] Ibid., 148.
[1473] Ibid., 182.
[1474] Ibid., 219.

teenagers.[1475] In fact, the book's broad appeal confused a few scientists, as well as librarians who had to determine how to classify the book.[1476] Was this science or history, adult or juvenile, scholarly or popular? It was all of those things and more. In fact, the book's style led geneticist-turned-historian Conway Zirkle to review the work for *Isis*. For Zirkle, two things had dawned on him while reading *Salamanders*. Foremost, he was being "educated painlessly."[1477] "Like his previous books," Zirkle wrote, "*Salamanders and Other Wonders* is beautifully written and never allows the interest of the reader to lag. The pace is rapid and the reading is fun. After a while, however, the reader is apt to be startled by realizing that the information he has been absorbing is important…"[1478] Zirkle then praised Ley as a pioneer in the field of the history of science: "Willy Ley is history-conscious and he presents each of his subjects in its historical context."[1479] Zirkle then made a long, but passionate appeal to fellow historians of science:

> All of Willy Ley's books on romantic natural history have ostensibly been written to entertain. On the surface they appear to be light literature—books to be read and forgotten. Actually, they are informative, scholarly and sound, and they emphasize aspects of the history of biology which most historians simply miss. Willy Ley shows beyond a reasonable doubt that scholarship need be neither solemn nor dreary, and that good scholarship, like good music or good literature, is basically enjoyable.[1480]

[1475] Incidentally, parts of the book were excerpted in *Science Digest*. See "Animals That Use Tools," *Science Digest*, November 1955, 29-35.
[1476] E. L. White, for example, argued, "It is difficult to be sure for whom this book is designed." E. L. White, *Review of Biology* 30 (December, 1955): 383.
[1477] Conway Zirkle, "Review," *Isis* 47 (December, 1956): 433.
[1478] Ibid.
[1479] Ibid.
[1480] Ibid., 434.

Zirkle concluded by stating, "if historians of science wish to secure recruits for their discipline, a most effective means would be for them to present Willy Ley's books to some of the brighter high school students."[1481]

Other scientists adored the book. For example, zoologist Fred R. Cagle admired the "daring of Willy Ley," as well as his "blending of zoological knowledge with personalities, history, and mythology [which] creates stimulating reading for both the zoologist and layman."[1482] He continued, "It is striking that Willy Ley, a free lance writer, managed to present more, substantial zoological knowledge than many zoologists have done in their popular writings."[1483] In fact, Cagle recommended that other zoologists study it as a guidebook for popular writing. Burt L. Monroe, ornithologist and chair of the University of Louisville's Biology department, called the book "serious scholarship and research" by an "author-scientist [who] deals with 'neoteny,' 'symbiosis,' 'metamorphosis,' 'evolution of species' and many other phenomena… couched in such understandable language that the layman has no difficulty in following."[1484]

Other reviewers praised Ley's style and research methods. A writer for *The Nation* argued that Ley "has a bloodhound's persistence in following trails through forgotten journals or obscure books. Give him a vulgar error or a lost animal to trace down the centuries and he is happy."[1485] Science writer Thomas Gardner further praised the book for *Scientific Monthly*: "The wonders of nature appear to be just as interesting

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[1481] Ibid.
[1482] Fred R. Cagle, "Review," *Copeia*, vol. 1956 (February 29, 1956): 71.
[1483] Ibid.
[1484] Burt L. Monroe, "Pleasant Dip Into Scholarship By A Romantic Naturalist," *Louisville Courier-Journal*, August 21, 1955, clipping from the WLC.
[1485] "Books in Brief," *The Nation*, October 3, 1955, 310.

as anything out of fiction. In my opinion, no writer has excelled Ley in describing both real and mythical things in nature, using a scholarly background in such a manner that the reader learns while enjoying the broad knowledge of the author."[1486] Gardner added, "Mystery, legend, and fact are blended together in a romantic form that makes this book equal to the companion volumes."[1487]

Critics appreciated the common themes that united Ley's works on rockets and the mysteries of nature. According to a reviewer, "Willy Ley is equally at home among prehistoric animals or space ships."[1488] Stanleigh Arnold also remarked that the book "again demonstrates the author's delight in wandering through a given field of science, discoursing as he goes."[1489] Although Ley "is generally known as a man whose eyes are firmly fixed on the firmament… he also looks with intense interest at the world and its odd inhabitants, past and present."[1490] A different reviewer noted, "While man seems about to penetrate the new frontiers of space, it would be fallacious to suppose that the last mysteries are about to be stripped down to the naked truth."[1491] Ley revealed that "this earth that man has occupied for a million years, give or take a few hundred thousand, still holds countless secret facts from him."[1492] The reviewer concluded, "Some of these weird tales… remain tantalizing puzzles to this day."[1493]

[1486] Thomas S. Gardner, "Review," *The Scientific Monthly* 82(3) (March, 1956): 143.
[1487] Ibid.
[1488] Collins, "What Happened to the Dodo Bird and Where Did the Waldrapp Go?" *Houston, Texas Chronicle*, August 14, 1955, page unknown. Clipping from WLC.
[1489] Stanleigh Arnold, "Book Review: From Salamanders, to Apers, to the Abominable Snowmen," *San Francisco Chronicle*, August 19, 1955, page unknown. Clipping found in the WLC.
[1490] Ibid.
[1491] "Naturalists Contribute Fine Books," *Dayton, Ohio News*, August 7, 1955, page unknown. Clipping found in WLC.
[1492] Ibid.
[1493] Ibid.

Naturalist and science writer Joseph Wood Krutch wrote one of the most widely circulated reviews of the book. In "Naturally It's Strange," he wrote: "Fascinated by whatever is far away, long ago, or for any other reason obscure and dubious, Willy Ley loves to trace legends, mysteries and persistent mistakes to their source and then down through the ages to our own time."[1494] The journey of the naturalist could lead to strange places. "Sometimes he ends up in a blind alley," Krutch noted, "sometimes with a solidly established fact, sometimes with an interesting guess and sometimes with an intriguing 'Who knows?'"[1495] Krutch added, "Because he leaves no stone unturned and is endlessly patient in tracing clues in out-of-the-way places, he rarely fails to turn up with something either illuminating or at least odd."[1496]

Salamanders was also described as a travelogue and travel guide. It illustrated how Ley's books were literally "voyages of discovery," according to August Deuleth.[1497] His landscapes were alien. The journey was bold. Readers co-experienced the moments of wonder, awe, and sheer amusement. As a whole, the book displayed the "enduring wonders of the world around us…" Ley's enthusiasm was infectious. Ley communicated "to his readers something of his own special kind of enthusiasm." This was, Deuleth concluded, "science writing at its very best; it is writing of precise knowledge, with imagination and spirit, and with a notable overlayer of the personality of its author." Ley "makes reading in zoology and other sciences an unforgettable pleasure." A different reviewer agreed, after commenting about the dull format of most science textbooks: "Now, if Willy Ley had written some of those textbooks, this reader

[1494] Joseph Wood Krutch, "Naturally It's Strange," *NYT*, August 29, 1955, BR6.
[1495] Ibid.
[1496] Ibid.
[1497] August Deuleth, "The Romantic Naturalist," *CDT*, August 28, 1955, B3.

is sure that the process of learning would have been more pleasant, more thorough and more permanent."[1498] Yet another commentator noted how Ley had "a flair for the rooting out strange creatures and a greater flair for telling about them in the proper mixture of romance and common sense."[1499] His romantic naturalism provided "after-dinner conversation of the next six months."[1500]

Face the Nation

In late July of 1955, President Eisenhower's Science Advisory Committee announced their intention of launching a man-made satellite within the next two years. Journalists and other commentators immediately turned to Willy Ley to interpret the significance of this announcement. Ley wasted no time in making the case that the decision "opens the age of space travel."[1501] As the "first step in space," the American satellite would pave the way for better satellites, which "will no doubt be bigger, more elaborate and longer-lasting." Ley stated, "In principle, the problem is not very difficult." Ley also had no trouble predicting the future: "The third or fourth [satellite] may well carry a television camera to show us what the planet Earth looks like when seen from space… By that time, a manned rocket ship will go into an orbit around the earth and after that engineers will begin to plan manned space stations." He concluded, "The artificial satellite is going to be a major accomplishment, but its main importance

[1498] Clarence W. Walton, "Some Old Secrets of Biology By a Romantic Naturalist," Norfolk, *VA Virginian Pilot,* August 28, 1955, clipping from WLC.
[1499] Lewis F. Ball, "Romance and Common Sense," *Richmond, VA Times Dispatch,* September 3, 1955, clipping from the WLC.
[1500] Ibid.
[1501] "Satellite Called Stride in Space; Experts Aware of Its Possibility," *NYT*, July 30, 1955, 9. Subsequent quotations in this paragraph are found on page 9.

will be that it will be followed by others… And after that, in time, there will be a manned artificial satellite that will travel through space."

On August 14th, 1955, Ley sat down in front of cameras for a long interview with CBS's *Face the Nation*. He answered a journalistic panel, which included William Hines of the *Washington Star*, Carleston Kent of the *Chicago Sun-Times*, and Erik Bergaust of *Aero Digest*. Host Ted Koop introduced Ley as a "leading lay rocket expert."[1502] Hines immediately launched into a question surrounding conflicting reports about a rocket already launched from White Sands. On the one hand, the scientific council had announced its intention to launch a satellite. On the other hand, reports circulated that this had already been achieved in secret, which the Pentagon denied. Hines added, "[T]he Pentagon went to such lengths to deny this thing that a great many people got the idea that the report was true. What can you tell us about it?"[1503]

This was one of the many instances where Ley found himself in the limelight. Although he was well removed from the centers of research and experimentation, as well as the avenues of military hierarchy, he had to discuss his perceptions of events. He was, after all, an expert on these affairs. "My personal reaction is," he stated, "I don't believe it, for the simple reason that getting a satellite into space is a possible but fairly complicated activity, and I do not think that this could happen by accident." Hines asked, "Well, do you think it could happen by design, to an altitude of 250 miles, which they are talking about now?" "Oh, certainly," Ley casually responded. He added, "We were in the theoretical stages about ten years ago. Ten years ago it became perfectly clear that it was not only feasible, from an engineering point of view, of sending a small

[1502] *Face the Nation, Volume 1, 1954-1955: The collected transcripts from the CBS radio and television broadcasts* (New York: Columbia Broadcasting System, Inc., 1972), 324.
[1503] Ibid.

satellite into an orbit around the earth; it was also clear that this would be a very useful experiment, that we would learn a great deal from it." Ley also stated, "Now, in these ten years, enough missiles have been built, tested, of various types, so that we, by now, should have reached the stage where, just by putting together various missiles, we should have a satellite carrier."

Kent then asked the "big" question: "Mr. Ley, what is this all going to lead to? What good will be accomplished in the whole thing?" Ley answered with a brief discussion of satellite data as necessary for the future conquest of space. Kent responded, "Then you're saying, in effect, that the major finding, out of this whole project will be to enable us to build space ships in which people can travel?" Ley confirmed, "This is precisely what I said, although I did not use the words, but this is only one of the results. In the meantime, we learn a lot of other things."[1504] After side-stepping issues surrounding the military implications, Ley then responded to a pressing question from Bergaust: "Well Mr. Ley do you feel that the Russians are really on par with us in rocketry?" Ley stated, "I wouldn't say on par, but… you don't have to be on par to shoot a satellite into space…" Bergaust responded, "Well do you feel that we are further advanced than the Russians in the field of electronics, for example?" "That, I believe," he answered, "In general, my feeling is, here, that the Russians can do it as well as we can, but that we can do it earlier, or faster or better, or all three."[1505] Ley then added his skepticism regarding Russian announcements: "Well, there is one thing with

[1504] Ibid., 325.
[1505] Ibid.

announcements coming out of Russia: You never know whether they are announcements, propaganda gestures, tests of public opinion, or whatever."[1506]

The panel then asked Ley to evaluate the major obstacles to manned spaceflight. Kent asked, "How long will it take, and what is the big problem?" "Well…" Ley answered, "my stock answer to the question about the major difficulty is the word 'financing?'"[1507] Kent pressed on the engineering difficulties, as often minimized by Ley and others. He then focused on the issue of reentry into the atmosphere. "Well supposes, isn't one of the big factors in this basketball project… based on the theory that the… projectile will be vaporized and consumed when it returns to the atmosphere, there will be no trace of it… How do you get over that hurdle, when you begin talking about manned ships and satellites?" Ley ruminated, "[T]he pilot could have the choice, especially if he has a winged ship, and he has to have wings for the final landing, to stay at a higher altitude for a longer period to get rid of the heat which his ship accumulated, and things like that."[1508] Ley then argued that a satellite could have been launched five or six years earlier, if financing had allowed for two to three years of innovation. At the conclusion of this interview, Kent asked, "Do you still think it would be valuable to go to the moon?" "At least once…" Ley answered, "it would be of scientific and possibly of practical value to go to the moon at least once."[1509]

Following this interview, Ley embarked upon another lecture tour.[1510] Then, he spent much of the following months revising and correcting his *Rockets*. He told

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[1506] Ibid., 326.
[1507] Ibid., 327.
[1508] Ibid., 328.
[1509] Ibid., 331.
[1510] Ley spent much of December on a lecture tour that took him through New Mexico, Kansas, and Missouri. He returned to New York City in early January to lecture on the "Man-Made Moon" at the American Museum of Natural History. Later that month, he returned to Chicago to make a "Return

Heinlein that supplies of existing editions were running low with an average sales rate of 100 per month. He then joked, "Wonder how many revisions I'll live through."[1511]

"Tomorrowland" and Beyond

Ley and von Braun's roles as consultants to Disneyland's "Tomorrowland" began to materialize in the summer of 1955, as the construction of the theme park neared completion. One of the most notable exhibits and experiences surrounded Trans World Airlines' mock rocket ship of the future, along with a "space theater" that would "take visitors to the moon and back."[1512] Visitors would marvel at the "76 foot rocket ship pylon, painted gleaming white with TWA's characteristic markings," before entering a large theater to experience to the everyday trip to the moon that would happen "about 30 years from now." A reporter for the *Chicago Daily Tribune* described the virtual experience. After TWA hostesses and pilots greet passengers, they took their seats for the journey to the moon. "Two scanning screens—one in the base and the other in the ceiling—will present a picture of what a passenger would see on a flight to the moon. Sound effects, air and temperature changes, and mechanical movements of the seats will confirm the illusion of actually being on a rocket ship flight to the moon and back to earth." Voyagers watched with wonder and awe as the earth retreated below, while the moon expanded above. The seats deflated to give the sensation of velocity. It was more than a simple amusement ride, according to commentators. Instead, Disney combined "animated cartoon style and the newest in three dimensional realism." The

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Engagement" on the question of "Have We Visitors From Mars?" See also, "Events Today," *NYT*, January 4, 1956, 20.

[1511] Ibid.

[1512] "TWA Offering 'Flight to the Moon' Feature," *CDT*, July 10, 1955, J3. All subsequent quotes in this paragraph can be found on this page.

ride was based on "the best scientific advice and knowledge available, including technical counsel by Dr. Wernher von Braun and Willy Ley, noted rocket and space scientists."

After making the journey from the earth to the moon, families could then tour "Space Station X-1." From a type of perched balcony, they would look down upon the earth to gain a "Satellite View of America."[1513] At a height of 90 miles and a speed of 60,000 m.p.h., "the round room slowly revolved around a beautiful, detailed landscape…"[1514] The audience would experience "Futurama" at the most extreme heights. Although it was a less popular and educational exhibit, it must have inspired wonder, awe, and enchantment. The future of Americans in space was guaranteed.

[1513] See Chris Strodder, *The Disney Encyclopedia: The Unofficial, Unauthorized, and Unprecedented History of Every Land, Attraction, Restaurant, Shop, and Event in the Original Magic Kingdom* (Santa Monica, CA: Santa Monica Press LLC, 2008), 37.
[1514] Ibid., 390.

Chapter 8: The Sputnik Challenge

Many scholars have analyzed a period of political, cultural, and technological "shock" that followed the launch of the first Soviet satellite on October 4, 1957.[1515] They have debated the causes, the implications, and especially the consequences. These debates often focus on institutional responses, political fallouts, and the role of presidential leadership.[1516] Typically, the "shock" of Sputnik is stressed in a way that helps to explain the events that followed, from the creation of NASA to massive governmental investments in education, science, and technology. Most famously, Walter McDougall's classic *The Heavens and the Earth* viewed Sputnik as a "saltation," defined as "an evolutionary leap in the relationship of the state to the creation of new knowledge."[1517] Although McDougall considered the legacy of the Second World War, he still saw Sputnik as a watershed moment: "What had intervened to spark this saltation was Sputnik and the space technological revolution."[1518] For McDougall, Sputnik I had "tremendous repercussions in the domestic as well as the international history of our time."[1519] Not only did Soviet successes undermine long-held notions of American technological superiority, but they also undermined assumptions about the superior nature of the American system, with its reliance on decentralized innovation and the secondary role of the state. Sputnik ushered in a new

[1515] For a good introduction to historiography, see *Reconsidering Sputnik: Forty Years since the Soviet Satellite*, eds. Roger D. Launius et. al., Amsterdam: Harwood, 2000).
[1516] See *Spaceflight and the Myth of Presidential Leadership*, eds. Roger D. Launius and Howard E. McCurdy (Urbane, IL: University of Illinois Press, 1997). See also, Gretchen J. Van Dyke, "Sputnik: A Political Symbol and Tool in 1960 Campaign Politics," in *Reconsidering Sputnik*, 365-400; John M. Logsdon, *John F. Kennedy and the Race to the Moon* (New York: Palgrave Macmillan, 2010).
[1517] Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age* (Baltimore and London: The John Hopkins University Press, 1997), 6, first published by Basic Books in 1985.
[1518] Ibid., 6.
[1519] Ibid., xix.

era of technocracy, thereby transforming the Cold War from a military and political struggle into a "total" competition.[1520]

McDougall later admitted that the term "saltation" was an overstatement, for retrospective reasons.[1521] Nevertheless, most scholars have shared his view of Sputnik as a crucial moment.[1522] Roger D. Launius put it simply: "Sputnik was a watershed, no doubt."[1523] The massive investments by the federal government in science, technology, and education indicate that 1957 and 1958 were transformational years, leading not only to the creation of NASA but also to the Advanced Research Project Agency, as well as the National Defense Education Act and increased funding for the National Science Foundation. Some scholars view these developments within a broader chronology that begins during the Second World War. Still, they tend to view Sputnik as one of the most important factors. In their historical narratives, notions of cultural, political, and technological "shock" are ever-present.[1524]

[1520] In the end, the legacy of the "Space Age" and the space race can be seen in the emergence of a "Big Brother." Ibid., 8-13.

[1521] See Walter A. McDougall, "Introduction: Was Sputnik Really a Saltation?" in *Reconsidering Sputnik*, xv-xx.

[1522] According to John A. Douglas, "In the late 1950s, Americans took comfort in the fact that they were the champions of this rational and mechanical art." Sputnik "shattered that vision, not only creating the image of an enemy capable of launching missiles of massive destruction, but a widespread fear that America had failed to nurture the sciences and build advanced technologies, with potentially horrifying implications." See John A. Douglas, "A Certain Future: Sputnik, American Higher Education, and the Survival of a Nation," in *Reconsidering Sputnik*, 327.

[1523] Roger D. Launius, "Preface and Acknowledgements," in *Reconsidering Sputnik*, xii.

[1524] For example, Audra J. Wolfe's recent book *Competing with the Soviets: Science, Technology, and the State in Cold War America* (2012) argues that Sputnik traced "a path of anxiety across the night sky," because it "came as a shock…" Wolfe continues, "What everyone could agree on was the need for *more*: more funding, more scientists, and more coordination." See Audra J. Wolfe, *Competing with the Soviets: Science, Technology, and State in Cold War America* (Baltimore: The John Hopkins University Press, 2013), 7 and 40. For a relevant and classic work, see Barbara Barksdale Clowes, *Brainpower for the Cold War: The Sputnik Crisis and National Defense Act of 1958* (Westport, CT: Greenwood Press, 1981). See also, Zuoyue Wang, *In Sputnik's Shadow: The President's Science Advisory Committee and Cold War America* (Rutgers University Press, 2008) Wang argues that Sputnik "sent a shock wave of apprehension through the West…" It also "led many, including President Dwight D. Eisenhower, to realize that a 'total Cold War' had dawned…" See Wang, ix.

It is understandable that many historians have focused on the aftermath of Sputnik, usually with an eye trained on politics and institutions. Although some historians would not call Sputnik "The Shock of the Century," as done by Paul Dickson, they tend to agree, "There was a sudden crisis of confidence in American technology, values, policies, and the military." [1525] Dickson added, ""National insecurity, wounded national pride, infighting, political grandstanding, clandestine plots, and ruthless media frenzy were but a few of the things the United States had to overcome to bounce back from the blow dealt to the nation by Sputnik."[1526]

An influential account can be read in Robert Divine's *The Sputnik Challenge: Eisenhower's Response to the Soviet Satellite* (2003). Arguably, this passage reflects a fairly dominant perspective in traditional historiography:

> The Soviet launch of the world's first satellite created a crisis in confidence for the American people. How could a backward Communist nation beat the United States into space? Many citizens reacted by questioning the vitality of an entire way of life, expressing concern that *Sputnik* signaled the weakness of American science, the failure of American schools, and the complacency of American political leadership. Worst of all, they feared that the Soviet Union had gained a lead in developing long-range missiles, thereby threatening the very security of the United States in the nuclear age.[1527]

Eisenhower's refusal to panic was not shared by scores of citizens, scientists, journalists, and politicians. Divine added that the "panicky response… had long-lasting effects on American life."[1528] Many scholars share this perspective. For example, Robert R. MacGregor summarized a widely-held historical view: "The launch of

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[1525] See Paul Dickson, *Sputnik: The Shock of the Century* (New York: Walker and Company, 2001), 4. For a popular account, see Matthew Brzezinski, *Red Moon Rising: Sputnik and the Hidden Rivalries that Ignited the Space Age* (New York: Times Books, 2007); Von Hardesty and Gene Eisman, *Epic Rivalry: The Inside Story of the Soviet and American Space Race* (Washington, DC: National Geographic, 2007).
[1526] Dickson, 7.
[1527] Robert Divine, *The Sputnik Challenge: Eisenhower's Response to the Soviet Satellite* (Oxford: Oxford University Press, 1993), vii. For a classic and influential defense of the Eisenhower administration's response to Sputnik, see Rip Bulkeley, *The Sputniks Crisis and Early United States Space Policy: A Critique of Historiography* (Bloomington, ID: Indiana University Press, 1991).
[1528] Ibid.

Sputnik was one of the most disruptive singular events in the history of the United States."[1529]

Some scholars, especially Divine, have charted the roles of popular media and journalism. Often, there is a dichotomy between the behind-the-scenes truths and "the" media. Most recently, this dichotomy has been pushed even further by separating media sensationalism from true public opinion. For example, Yanek Mieczkowski's *Eisenhower's Sputnik Moment: The Race for Space and World Prestige* (2013) argues that the "Sputnik uproar was more apparent than real."[1530] He continued: "It was the press and politicians who generated noise, capitalizing on the event for attention and electoral gain. The Sputnik 'panic' showed the divergence between popular opinion and elite voices, a chasm some historians have tried to close by describing the public as fearful and traumatized by Sputnik."[1531] Mieczkowski doubts the degree to which ordinary Americans grew concerned about the implications. Conversely, both journalists and politicians saw a golden opportunity. As journalists "played up the angle of a 'space race' that the United States had lost," keen politicians pounced on Eisenhower with a vengeance.[1532] In this regard, "Sputnik marked the start of a concerted political offensive against Eisenhower that lasted for the rest of his presidency."[1533] At this point, the story becomes more complex as a larger cast of

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[1529] Robert R. MacGregor, "Imagining an Aerospace Agency in the Atomic Age," in *NASA's First Fifty Years: Historical Perspectives*, ed. Steven J. Dick (Washington, DC: National Aeronautics and Space Administration, 2006), 31.
[1530] Yanek Mieczkowski, *Eisenhower's Sputnik Moment: The Race for Space and World Prestige* (Ithaca and London: Cornell University Press, 2013), 2.
[1531] Ibid. 2-3.
[1532] Ibid., 22-23.
[1533] Ibid., 23. Mieczkowski describes Lyndon B. Johnson in these terms: "Johnson especially orchestrated the post-Sputnik fallout to work in his favor, grabbing headlines with spectacular quotes…" Like Kennedy, he took advantage of an opportunity to use Sputnik in a way that "ripped off the veneer that critics claimed covered Eisenhower, exposing a part-time, golfing president who allowed the Soviet

characters focused on the issue, often for self-serving reasons.[1534] Mieczkowski added, "Sputnik also showed media at its worst…"[1535] Unlike the public, he argued, "The media… showed inordinate interest… because Sputnik made good copy."[1536]

Arguably, a more traditional and moderate stance is warranted. If Sputnik "made good copy," it was because magazines that contained news on the topic sold well, therefore indicating a popular demand for such news and information. As Glenn Hastedt noted, "The loss of public confidence in Eisenhower was not due simply to the actions of circulation-hungry press or opportunistic political opponents who wished to make Eisenhower look bad. Sputnik touched a raw nerve that both excited and frightened the American public in a way that the Eisenhower administration had not anticipated."[1537]

While historians will continue to debate the political implications, the role of the media, and public perceptions of these events, they can do more to document Hastedt's claim that Sputnik both excited *and* frightened the American public. They could also do more to chart the public expectations throughout 1957, as well as the reactions to news of the Soviet satellite.[1538] Foremost, if historians seek to better understand public expectations and reactions, then we need to focus on the public's sources of information, beyond notable issues of popular magazines. For a historiography that makes bold claims about cultural and technological "shock," there have been very few cultural histories surrounding "one of the most disruptive singular events in the history

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Union to surpass the United States." This perspective has obviously been influenced by the work of Rip Bulkeley.

[1534] Ibid., 25.

[1535] Ibid., 26.

[1536] Ibid., 22.

[1537] Glenn P. Hastedt, "Sputnik and Technological Surprise," in *Reconsidering Sputnik*, 401.

[1538] In many ways, W. Patrick McCray's wonderful *Keep Watching the Skies!* offers an informative and useful guide for future investigations. See McCray, *Keep Watching the Skies! The Story of Operation Moonwatch and the Dawn of the Space Age* (Princeton: Princeton University Press, 2008).

of the United States."[1539] If we wish to broaden our perspectives on the cultural history of aerospace, then we need to continue to investigate space-related media, artifacts, and exhibits.

Arguably, there has been an imbalance in historiography, due to the traditional focus on institutions, Cold War politics, and the moment of "crisis," which instigated popular fears, crushed expectations, and unleashed "technological surprise." Ironically, the "dawn of the Space Age" has not typically been depicted as a blossoming of public enthusiasm, despite the many recognized efforts of early spaceflight advocates. Even Howard McCurdy's influential *Space and the American Imagination* portrays early 1957 as somewhat of a lull in the effectiveness of popularizers. He argued, "By themselves, the early efforts to promote the exploration of space were not sufficient to unleash the billions of dollars necessary to undertake the endeavor. The spirit of adventure and discovery to which much of the early promotional efforts appealed did not justify such a large commitment."[1540] In some ways, the popularizers had reached a dead end, although they continued to entertain. It took the shock of Sputnik and the broader context of the Cold War to instigate large-scale governmental investment.

This chapter does not critique this view. Indeed, the motivating factors at the root of many post-Sputnik investments were fear and opportunism. The context of the Cold War was incredibly influential. Nevertheless, this chapter argues that historians could still do more to survey pre-Sputnik media and spaceflight advocacy. By exploring newspapers, magazines, and broadcasts, they could better chart the influence of

[1539] Robert R. MacGregor, "Imagining an Aerospace Agency in the Atomic Age," in *NASA's First Fifty Years*, 2006), 31. There are several important first steps in the right direction, which will be further incorporated in this chapter.
[1540] McCurdy, *Space and the American Imagination*, 60.

advocates, who contributed to rising public expectations for an immediate future of Americans in space. These expectations contributed to a sense of shock that followed Sputnik. In this sense, the role of pre-Sputnik media was incredibly influential. The story becomes far more complex than an analysis of public reactions, institutional consequences, and political opportunism. The story also becomes one of continuity rather than complacency and rupture.

Historians could also widen their cast of characters beyond the traditional focus on Wernher von Braun. No doubt von Braun is incredibly important to the larger story. As Michael J. Neufeld argues, post-Sputnik media catapulted von Braun to national fame. From the cover of *Life* magazine to a biographical movie, *I Aim for the Stars* (1960), von Braun became a national hero and a technological savoir, particularly after the successful launch of an American satellite in January of 1958. Neufeld claimed, "Within four months… he was a bona fide American hero, the Western world's most prominent gladiator in a celestial contest with the Soviets."[1541] Von Braun was also one of the most influential individuals behind-the-scenes. Consequently, Neufeld's biography is a rich history of institutions, committees, hierarchies, and technological programs.[1542]

Both the dominant focus on the national politics of Sputnik and the biographical focus on von Braun illustrate the institutional character of space history as a field. Much more could be said about a broader group of science writers and "outsiders" who

[1541] Neufeld, *Von Braun*, 312.
[1542] For other (less balanced) biographies, see Wayne Biddle, *The Dark Side of the Moon: Wernher von Braun, the Third Reich, and the Space Race* (New York: W.W. Norton and Co., 2009); *Dennis Pisziewicz, Wernher von Braun: The Man Who Sold the Moon* (Westport, Connecticut and London: Praeger, 1998). For sympathetic accounts, see Bob Ward, *Dr. Space: The Life of Wernher von Braun* (Annapolis, Maryland: Naval Institute Press, 2005); Ernst Stuhlinger, *Wernher von Braun, Crusader for Space* (1994).

spent much of 1956 and 1957 making bold predictions that raised public expectations for the immediate conquest of space. As Emily S. Rosenberg reminds scholars, "a vibrant spaceflight movement comprised largely of science fiction writers and engineers had preceded Sputnik and helped set a tone for the space race that emerged in Sputnik's wake."[1543] Arguably, the science fiction writers, especially Isaac Asimov, Theodore Sturgeon, and L. Sprague de Camp acted more directly as non-fiction science writers. A more precise definition of "a vibrant spaceflight movement" would include far more journalists, science writers, intellectuals, and educators who excited the American public about the immediate conquest of space.

This chapter cannot hope to provide a comprehensive account of this group, but it will begin an investigation by focusing exclusively on Willy Ley. As a science writer, Ley operated outside of institutions. He never testified before a congressional committee. Rarely did he engineer rockets, unless toy models count. He was disconnected from important decisions, closed-door meetings, and inter-service rivalries. Nevertheless, precisely because of his status as a "rocket expert," he was an incredibly important figure in mass media. If historians are seeking answers about the role of media and the extent of a "panic," then Ley's writings reveal much about pre- and post-Sputnik scene.

Ideally, what is revealed about his activities and methods will invite other historians to continue to expand their focus to other individuals like Arthur C. Clarke, Robert A. Heinlein, and G. Edward Pendray, as well as key science writers like Waldemar Kaempffert and Walter A. Sulivan. By focusing on an individual who

[1543] Emily S. Rosenberg, "Far Out: The Space Age in American Culture," in *Remembering the Space Age*, 158.

operated almost exclusively in popular media, this chapter invites scholars to not only reconsider our narratives surrounding the Sputnik challenge, but also to approach the questions of public perceptions somewhat more broadly than Cold War politics, particularly in 1956 and 1957 when public excitement dramatically increased. Ley's pre-Sputnik popularity indicates widespread fascination with an immediate conquest of space and the International Geophysical Year.

Overall, this chapter argues that we can learn much about both pre-Sputnik and post-Sputnik media by more fully documenting the activities, tactics, and goals of Willy Ley, who did so much to fuel public expectations. As a journalist later noted, "Willy Ley was one of the first scientists to whom the newspapers turned for explanations as well as predictions on the future of space activities."[1544] Arguably, he was the most influential advocate prior to Sputnik, and he continued to be incredibly influential throughout 1958. His daily activities reveal the extent of his influence in the popular press. For example, in late October of 1957, Ley described his daily routine in a letter to Robert A. Heinlein: "Yesterday I had the first non-business lunch since October 4th… and over the weekend I'll have to produce some 5000 words of copy plus about 20 letters… Sputnik zemli has brought me a lot of cash, I must say that for it."[1545] In his capacity as a public expert, Ley gained a reputation as reliable and trustworthy. One reporter described him with these words: "Willy Ley is indeed an unusual person—a refugee from Hitler's Germany who now works in an unofficial capacity for the United

[1544] "Scientist Catapulted to Fame," Athena, *Oregon Press*, December 11, 1958.
[1545] Ley to Heinlein, October 26, 1957, HA, corr. 310-3.

States Government as disseminator of information and a vital force for national and international understanding."[1546]

Although he lacked von Braun's hero status, Ley shared the stage in an influential way. Many of his activities have been overlooked in secondary literature. By studying Ley's contributions to the pre-Sputnik scene, this chapter will first highlight his influence among a general readership of newspapers and magazines. It will also explore his continuing efforts to excite audiences about an immediate future of Americans in space. It will demonstrate that historians can better appreciate a wide range of space-related media, along with a diverse American audience of both adults and children. An analysis of Ley's books reveals his evolving tactics, which included focusing on juvenile audience in order to excite children about the future of spaceflight. He attempted to shape the future by inspiring a younger generation to dream.[1547] It is hoped that this section will encourage other scholars to take juvenile literature and toys more seriously.[1548] This chapter will then follow Ley's reactions to Sputnik and his changing tactics to educate and excite the public in 1958 and 1959. Not only did Ley contribute to post-Sputnik hopes, but he also contributed to fears about cultural "lag" and "missile gaps." Understanding his influence takes us closer to understanding public perceptions of the Sputnik crisis. Likewise, understanding his motivations and tactics

[1546] "Scientist Catapulted to Fame," *Athena, Oregon Press*, December 11, 1958.
[1547] To some degree, Ley's tactics displayed continuity with a longer tradition of "teaching children science." Although many of the diverse practices of "hands-on nature study" had declined in American public schools, his books continued to teach children science by exciting a reader's imagination through virtual witnessing and travelogues. For a detailed account of rise and fall of "hands-on nature study," see Sally Gregory Kohlstedt, *Teaching Children Science: Hands-on Nature Study in North America, 1890-1930* (Chicago and London: University of Chicago Press, 2010).
[1548] As Asif A. Siddiqi notes in his survey of historiography: "An area ripe for investigation is the ways in which popular space culture shaped the lives of adolescents in the 1960s through science fiction, popular magazines, toys, models, and clubs." See Asif A. Siddiqi, "American Space History: Legacies, Questions, and Opportunities for Future Research" in *Critical Issues,* 475.

helps us to view his work in the broader context of a wide range of scientists and politicians who mobilized for science, education, and spaceflight.

Hopes, Predictions, and Tactics

Ley spent much of 1956 and 1957 predicting an immediate future of Americans in space. Most of these predictions championed ideas that he and von Braun had been voicing for several years.[1549] Most notably, their jointly authored *The Exploration of Mars* depicted an ambitious first voyage to Mars with two ships and 12 men. Granted, the book presented a scaled-down version of von Braun's earlier designs for a massive 12-ship convoy. Nevertheless, the book communicated a vast sense of optimism regarding human spaceflight. Science writer John Pfeiffer voiced his admiration: "Their latest imaginary adventure is spelled out to the finest possible detail on the basis of modern space technology."[1550] The *Wall Street Journal* also noted, "Once again, Willy Ley and Wernher von Braun have hurtled the future into our laps… these indefatigable rocket experts have presented a down-to-earth 'how-to' master blueprint of Earthman's exploration—'within a matter of decades'—of the planet Mars."[1551] This book did much to fuel public expectations for an immediate conquest of space.

Other predictions focused on the successful launch of American satellites during the International Geophysical Year. According to Ley, these satellites would lead to a relatively easy path upward, from the launch of a manned rocket to the establishment of a space station. By exploring these predictions, we gain a better understanding of the

[1549] See Willy Ley and Wernher von Braun, *The Exploration of Mars* (New York: Viking, 1956).
[1550] John Pfeiffer, "Traveling In Space," *New York Times*, June 24, 1956, BR6. For the remainder of this chapter, the abbreviation *NYT* will be used in footnotes. Abbreviations for other newspapers will follow.
[1551] "Reading for Pleasure: How to Visit Mars," *Wall Street Journal*, June 22, 1956, 6.

optimism that characterized Ley's spaceflight advocacy. This optimism and faith in American technology (and by extension the American system) encouraged many Americans to imagine and expect technological marvels. They also contributed to a sense of shock at the news of Sputnik.

Many of Ley's articles glorified a new era of human exploration. For example, the widely-read January 1957 edition of *Science Digest* communicated his predictions with much enthusiasm for future achievements. Ley argued that the "really big headlines will come in a year or so, when the first Vanguard three-stage rocket roars into the sky… to carry the first American artificial satellite into an orbit around the earth."[1552] According to Ley, Project Vanguard would unleash a wave of scientific discoveries.[1553] Ley also stated that Vanguard would present "definitive figures for the density of the atmosphere at very high altitudes," while the satellite's destruction in the atmosphere would provide clues about the problem of re-entry.[1554]

Vanguard would be one of many shots "designed to ferret out another set of unknowns." After Vanguard, an atomic or solar powered satellite would use a television camera to peer down upon the earth. Ley argued, "The color picture taken by this camera and broadcast to the ground will have no military value whatsoever. But it will be of utmost value to meteorologists who will be able to see, for the first time since the foundation of their science, how the currents in the air over half the globe are behaving at a given moment."[1555] Within ten or twelve years, a network of satellites would broadcast television. By that time, the problem of re-entry would likely be solved,

[1552] Willy Ley, "Rockets into Space," *Science Digest*, January 1957, 65.
[1553] Ibid., 69.
[1554] Ibid.
[1555] Ibid., 69-70.

which "will open the gate for two developments."[1556] Ley explained: "One would be the long-range rocket-propelled passenger liner… which could cross the Atlantic outside the atmosphere in not quite an hour."[1557] The second development surrounded the conquest of space as three-stage rockets ascend with components of a space station, to be constructed quickly once the necessary components are in stable orbit. Ley then predicted the future based on his perceptions of the past: "Just about two decades elapsed between the drawing of the preliminary plans for the first large rocket to the drawing of the plans for Vanguard. Between the first Vanguard shot and the assembly of the first manned space station another two decades may elapse. But the time in all probability will be shorter."

Ley also made similar predictions in the pages of *Galaxy*.[1558] For example, the February issue contained an article titled, "Between Us and Space Travel."[1559] Ley outlined the three main obstacles that had to be overcome: the "re-entry problem," the physiological effects of "cosmic rays," and effects of zero gravity on man's body. On the first issue of re-entry, Ley was quite optimistic: "It is rather safe to say that the re-entry problem is not solved at this moment. But engineers feel sure that they can solve it, provided they have exact and reliable figures to work with."[1560] Ley added, "The artificial satellites will provide these figures."[1561] Additionally, the satellites would help solve the problem of the cosmic rays by measuring their effects. On the difficulties, Ley simply argued, "The answer is that we don't know yet… But we'll find out. And when

[1556] Ibid.
[1557] Ibid.
[1558] See Willy Ley, "The Coming of the Robots," *Galaxy,* April 1957, 49-58; "Who'll Own the Planets, May 1957, 51-62; "The Moon Contract," June 1957, 61-71; "Our Missile Arsenal," August 1957, 72-83; "The Spaceship in the Basement," December 1957, 57-68.
[1559] Willy Ley, "Between Us and Space Travel," *Galaxy*, February 1957, 100-110.
[1560] Ibid., 102.
[1561] Ibid.

that has been done, another barrier between us and space travel will have been removed."[1562]

Most likely, Ley made similar predictions on radio and television broadcasts that are now lost. Throughout 1956, Ley appeared on *This is New York*, the "Tex and Jinx Show," and other programs.[1563] He also gave many public lectures prior to the launch of Sputnik in 1957.[1564] Venues included lecture halls, rotary clubs, hotels, museums, churches, and radio institutes.[1565] Most notably, he informed an audience of Navy reservists that "all of the materials and mechanisms needed by engineers to build the Vanguard were known and in use by 1900, but there was no theory that said it could be done."[1566] He probably gave a similar lecture to an audience at the annual meeting of the Amateur Astronomers Association. He titled the talk "Man-Made Moon."[1567] As early as February 1956, Ley voiced his confidence that Vanguard would launch the first satellite into space in late 1957.[1568] He presented the man-made satellite as an American accomplishment, destined to succeed.

[1562] Ibid., 103.
[1563] See "On Radio" *NYT*, June 28, 1956, 59 and July 20, 1956, 29.
[1564] Key lectures on satellites included various talks on "The Conquest of Space" and "Earth Satellites and Their Scientific Importance," given to the Princeton Institute of Radio Engineers, May 10, 1956. See *The P.S.*, Volume 2, number 4 (May 1956): 1.
[1565] On the New Jersey Institute of Radio Engineers, see *The Scanner*, Volume 6, number 4 (February, 1956), cover. University appearances included lectures at Washington University on December 6, 1955, The University of Missouri on December 9, 1955, and Kansas State College on December 13, 1955.
[1566] "Ley Contends New Vanguard Satellite Could Have Been Built 50 Years Ago," *NYT*, April 22, 1956, 73.
[1567] See "Events Today," *NYT*, January 4, 1956, 20.
[1568] This confidence is reflected in lecture brochures. See *The Scanner*, 2.

Rockets, Revised

1957 also marked the most extensive revision to date of *Rockets, Missiles, and Space Travel*.[1569] By this point, the book was a best seller. Exact sales figures are unknown, but based on a survey of correspondence, the public demand for Ley's book rose steadily between 1954 and 1957, although it sold quite well in the early 1950s. According to the inside cover of a 1958 reprint, Ley's 1957 edition of *Rockets* went through six printings by the fall of 1958.[1570] Additionally, reviewers and advertisements labeled the book as "the" definitive book on space travel and rockets. It was at this moment, to quote historian Roger D. Launius, the book became "one of the most significant textbooks in the mid-twentieth century on the possibilities of space travel."[1571]

Ley's changes to the text are telling. He entirely removed his chapters "The Meteorological Rocket" and "Terminal in Space." Mostly likely, he did this to make room for a new chapter on satellites, titled "The Shot Around the World." This addition illustrates how Ley catered a new chapter to provide the public with answers about pressing questions. The chapter began, in part, with a reassurance regarding predictions. Ley wrote, "I have repeatedly said that I know of no other science which has such a magnificent record of living up to its own predictions as rocket research has had."[1572] Nevertheless, many theorists had overlooked the possibilities surrounding an unmanned and permanent vehicle orbiting the earth. They had failed to anticipate the art of "telemetering." On the satellite, Ley answered the public's central question of "What

[1569] Willy Ley, *Rockets, Missiles, and Space Travel: Revised Edition* (New York: Viking, 1957).
[1570] Of course, these numbers are inconclusive because the printing quantities of each edition are unknown.
[1571] Roger D. Launius, *Frontiers of Space Exploration* (Westport, CT: Greenwood Press, 1998), 190.
[1572] Willy Ley, *Rockets* (1957), 323.

holds it up?"[1573] Much of this discussion anticipates the success of Project Vanguard, "the satellite shots to be made during the International Geophysical Year of 1957-58."[1574] The text does not comment on possible Soviet achievements. Instead, the unmanned satellite is presented almost entirely as a new idea, first inaugurated in army circles, and then put forward more directly by Ley in a 1949 article for *Technology Review*.[1575]

This presentation is a curious contradiction to the actual content of his December 1949 article, which presented the idea as "not really new."[1576] In the original article, Ley mentioned a 1946 report by Defense Secretary James Forrestal. Ley attributed the gem of the idea to German pioneers: "The German literature of the pre-Hitler period dealt with manned artificial satellites, which were intended to serve as refueling stations… An artificial satellite was 'obviously' useless without at least one observer, and an observer could reach the satellite only by piloted rocket."[1577] By 1949, Ley's attitude had changed: "Because we now have instruments which not only register their readings but which can also report their findings by radio, a satellite rocket can be quite useful without a living observer."[1578]

Ley's new addition to his 1957 *Rockets* took the case further. The book also reflected on the broader scene. Suddenly, newspapers and magazines buzzed with talk of satellites and space travel. Here, Ley spoke directly to future historians:

> It would not surprise me too much if somebody in the future tried to make out a case that during the years 1953 and 1954 a number of "space-happy" scientists

[1573] Ibid., 323. The book contains a diagram very similar to the one drawn by Ley on Disney's "Man in Space" television special.
[1574] Ibid., 327.
[1575] Ibid., 328. See Ley, "The Satellite Rocket," *Technology Review*, December 1949, 93-95, 112-116.
[1576] Ibid., 93.
[1577] Ibid.
[1578] Ibid.

> (to use a term coined by Robert A. Heinlein) carried out a conspiracy to talk their government out of tax money for their wild schemes. Scientific institutions, public lecture halls, the magazines, the newspapers, the radio waves, and the television channels were full of space-travel and satellite talk. To discourage a possible future compiler of such a story at the very outset I can tell him that it all more or less just happened. The dozen or so men who talked space travel had talked space travel all their adult lives, but the time was ripe and they had, quite literally, bigger and bigger opportunities for talking.[1579]

Ley added, "One thing had simply led to another." Public excitement for American spaceflight was at its peak intensity. Adults and children clamored for information.

Sugar Jets in Space

In mid-1957, Ley entered into an agreement with Sugar Jets Cereals, which unleashed a massive marketing campaign aimed to increase sales by offering space age rewards to children who located special boxes of Sugar Jets. This campaign also centered on spaceflight television commercials that aired during *The Mickey Mouse Club*. Ley (along with physicist Joseph Kaplan, teacher John Sternig, and artist Chesley Bonestell) consulted the producers of these futuristic commercials.[1580] A reporter described one of the 90-second commercials as "one-third advertisement and two-thirds information about rockets and space travel."[1581] In the perspective of John Sternig, the commercials were the cutting edge of an educational revolution. The commercials would "awaken a teacher's interest in… a 'multisensory' method of teaching, using films, TV, and other audio-visual aids."[1582] They depicted the immediate American

[1579] Ibid., 330.
[1580] See Larry Walters, "TV Ticker," *Chicago Daily Tribune*, July 20, 1957, C4. See also, John Fink, "Space Expert Helps Kids to Learn About It." *CDT*, August 25, 1957, SW14.
[1581] Fink, "Space Expert," SW14.
[1582] Ibid., SW15.

conquest of space. Sugar Jets also made an "amazing double offer."[1583] If children sent a special box top, plus $1.00, Sugar Jets delivered an 18-inch telescope, which could be used to "see the flight of the first man-made satellite that may be circling the earth this very year!"[1584] Young stargazers would receive a "Sugar Jets' Space Map," which guided them to find both the constellations and the American satellite.

The space map was not part of the "amazing double-offer." The second offer related to a new and exclusive book by Ley, titled *Man-made Satellites*. [1585] With 50 cents and a special box top, a Sugar Jets fan would receive this "complete easy-to-read account of the soon-to-be-launched man made satellites!" An ad proclaimed it "Not fiction. The real story."[1586] The ad then announced: "The Jet Age is no longer a dream! Scientists all over the world have declared 1957-58 as the *International Geophysical Year*! Yes, this year start your world of the future—your world of adventure—*your world of outer space!*" The ad concluded with the words: "Don't delay. Get your copy of 'Man-Made Satellites,' and your Space Telescope right away! Remember, you can get them only from SUGAR JETS."

Ley's *Man-Made Satellites* was only 44 pages, with 32 illustrations by John Polgreen. The first sentence of the book read, "This is the Special Events Division of your local station. We are now switching you to Patrick Air Force Base in Florida for the firing of the first artificial satellite of the International Geophysical Year. This newscast will be carried by all the networks. Take it away Florida."[1587] The

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[1583] "Display Ad 191," *CDT*, July 28, 1957, G3
[1584] Ibid.
[1585] Willy Ley, *Man-Made Satellites* (Poughkeepsie, NY: Guild Press, 1957).
[1586] The book also answered key questions, such as "What will the satellites be made of? How will they be launched? What will hold them in outer space? Will they collide with stars?—and dozens of other exciting facts you'll want to know!"
[1587] Ibid., 7.

commentary shifts to a reporter on the scene, excitedly informing readers about Project Vanguard, which was "the shot around the world." The countdown begins at "X minus 20 minutes," as scientists and engineers signal their status as "ready." Then came the final thirty seconds, which "seem to take longer than thirty minutes in the outside world."[1588] The text culminates in a dramatic lift-off: *"One… Zero… Fire!"* [1589] Spectators marvel as the rocket ascends. They "draw a deep breath and reach for their field glasses."[1590] The launch culminates with the words: "Earth's first artificial satellite is on its way."[1591]

The remainder of the book explains the physics of the rocket's ascent and the satellite's orbit. Ley also predicted a permanent satellite that sent pictures and information back down to the earth. This satellite would save lives by giving meteorologists advanced warning of extreme weather. One of Polgreen's illustrations depicts a weather control center of the future, along with the meteorologists who protect the earth. The book ends with a dramatic image of the next step, a manned spaceship. Ley wrote: "In less than a decade some men will look through the pressure-proof and radiation proof windows and see the wide curve of the earth below. They will look up and see that the sky is black. And they will know that they are in space."[1592]

This book was enormously popular with young readers. A journalist recalled, "…the demand has been tremendous."[1593] The success prompted General Mills to immediately commission a second book by Ley. Published as quickly as possible, *Space*

[1588] Ibid., 8.
[1589] Ibid., 8-9.
[1590] Ibid., 9.
[1591] Ibid.
[1592] Ibid., 44.
[1593] "Scientist Catapulted to Fame," *Athena, Oregon Press*, December 11, 1958, clipping in WLC.

Pilots enchanted young readers. Whereas the first General Mills book focused on technology, the second book described "the *people* who will fly the rocket ships."[1594] Ley added, "Some of you may be among those who will be trained for this task."[1595] The first chapter is somewhat similar to the earlier launch sequence of *Conquest*. The text read, "People riding home from work turned on their car radios for news from 'Moonport,' and newspaper readers opened their papers with the same thought."[1596] This American-owned "Air Force Base" in the Virgin Islands would be the first rocket port.

Ley described the scene as the excitement soared before the moment of the launch, when the sunset enhanced the scene as the "ship looked like an enormous, illuminated red arrow."[1597] Seven men rested on their backs in the cabin, waiting for the countdown. They have been well prepared. "Every man aboard can do every job," Ley wrote, "they have practiced for months with training devices, and they have proved themselves in a 6,000-mile flight with a two-stage ship, the *Hermes*."[1598] Everything operated smoothly: "…window shutters secure, telemeter *on*, cabin TV *on*, radar *on*,--over.' 'Receiving all signals loud and clear, cabin TV picture sharp and clear.'"

The countdown began. While spectators marveled, the crew remained calm. For them, it was a matter of routine. Ley described the launch in nonchalant language: "The crew on the distant tanker sees a tower of flame building up from the base. It grows slowly at first, then faster and faster. The X-49 is on her way."[1599] "Moonport" carefully

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[1594] Willy Ley, *Space Pilots*, illustrations by John Polgreen (Poughkeepsie, NY: Guild Press, Inc., 1957), foreword.
[1595] Ibid.
[1596] Ibid.
[1597] Ibid., 8.
[1598] Ibid., 9.
[1599] Ibid., 11.

monitors every aspect of the ship, its instruments, and its crew. The astronauts easily adjust to weightlessness. Then, they spend a full day orbiting the earth, making scientific observations, and answering questions from the ground. Because their stage of the rocket doubled as a winged glider, re-entry went smoothly. Overall, landing the craft was "a simple approach to the long runway in fine weather."[1600] When the crew is safely landed, the base "breaks its self-imposed silence and tells the world: 'The X-49 has accomplished its mission. Man's first trip into outer space is completed.'"[1601]

The remainder of *Space Pilots* describes what it takes to make the grade at space academy. Unlike the 24th-century space academy of *Tom Corbett*, this Space Academy, U.S.A. was just beyond the horizon. The selection process would be unforgiving. The cadets must be physically and mentally fit. They must be exceptional pilots, as well as mechanics.[1602] The young men would also demonstrate a strong understanding of biology and astronomy. Ley argued, "He must not only know the constellations, he must be able to find the major planets at any time when they are visible, and must be able to tell where they are when they are not visible from the ground."[1603] Ley admits that experts on the ground will do much of this work. Still, it will be crucial for the space pilot to possess some degree of expertise in complex mathematics. He must be an exceptional student: "When he is finished with his studies he will know a great deal of engineering; he will have mastered some branches of astronomy; he will know a great deal about higher mathematics; he will have studied some aspects of medicine… All

[1600] Ibid., 15.
[1601] Ibid.
[1602] Ley wrote, "Every pilot has to learn how the engines in his planes work and the reasons why an airplane flies. But the future space pilot, in addition to that, has to be able to design a rocket motor—just as an exercise—and has to listen to lectures… He not only has to listen to such lectures, he has to be interested in the problem and must understand what the lecturer says." Ibid., 17.
[1603] Ibid.

this in addition to having become a pilot."[1604] The book illustrates these points with a picture of a young Caucasian man, clean-cut and well dressed, laboring through a stack of large books.

Space Pilots then turns to individual topics, such as the period of ground testing that the pilots would endure, along with a discussion of the animals that "did it first." Ley predicted a wide use of simulators and stress tests. Ley also predicted a transition from the experimental X-49 to commercial passenger liners that could travel from New York to London "in about one hour," if the trips can be made affordably.[1605] Ley then ruminates on a space station, which would be manned with research scientists "investigating the laws of nature."[1606] He argued, "Some day passengers on transcontinental or trans-oceanic flights will see the space station overhead, and will wonder at that moment what the researchers are doing to change their lives."[1607] Ley further advanced these themes in two subsequent General Mills books.[1608]

American Missiles

Despite such optimism in his popular books, Ley recalled that 1957 "was a year that offered no comfort to Americans."[1609] Although few details were publicized, Ley followed the failed launches of the Thor missile with continued disappointment. He was greatly surprised by Thor "103" which "exploded on the pad at T – 4 minutes!"[1610] Ley recalled, "That a rocket might explode some time after ignition was a sad but known

[1604] Ibid.
[1605] Ibid., 41.
[1606] Ibid., 44.
[1607] Ibid.
[1608] See *Space Stations* (1958) and *Space Travel* (1958).
[1609] Willy Ley, *Rockets, Missiles, and Men in Space* (1968), 330.
[1610] Ibid., 330.

fact. That it might explode on ignition was also known. But how could a missile explode four minutes *before* ignition?"[1611] Ley also followed reports about the Atlas 4-A, which exploded one minute after launch on June 11, 1957. Ley remembered, "The public was dismayed, to put it mildly. The Atlas incident had been visible to everybody for miles around, unlike the Thor failures which could be kept secret (though the fact that something had gone wrong became known anyway)."[1612] On the role of the press, Ley foreshadowed the events to come: "…newspaper reporters, editorial writers, radio commentators took the position that such a big rocket simply could not be made to work; they did not mention the fact that about half a century earlier some airplane crashes had also been taken to be proof that 'flying machine' could not work."[1613] Ley added, "Some wondered whether the explosion could have been engineered by Russian spies; one writer speculated that the Russians might be able to make our rockets explode by 'jamming' from a submarine. And one simply blamed 'the unions.'"[1614] By August, the scene of American rocketry was not encouraging. According to Ley, "even those who knew all the events" had good reasons to feel discouraged. Ley described the general scene: "No Thor missile had made a successful flight, a Jupiter missile had malfunctioned, and the only Atlas flown had exploded… The Russian chose this month to announce that they had an ICBM… it deepened the gloom. And no relief was in sight."[1615] Ley recalled a series of other failures throughout September.

[1611] Ibid., 331
[1612] Ibid., 331-332.
[1613] Ibid., 332.
[1614] Ibid.
[1615] Ibid.

The Shock of Sputnik

When the Soviet Union launched a satellite on October 4, 1957, Americans looked to the sky. Some parents may have borrowed their child's Sugar Jets telescope to look in vain for the object. Others tuned in their radios to hear hourly reports of the satellite's current location. If historians take the press accounts at face value, most Americans were deeply disturbed and frightened. The technological triumph of a Soviet technology represented a triumph of the Soviet system in the realm of science and technology. Americans were shocked.

In order to understand the extent of a panic, as well as Ley's subsequent activities as a science writer, it is important to stress the themes of earlier chapters. Many scientific intellectuals, including Ley, had contrasted a scientific democracy with a totalitarian regime that would invariably stymie freedom of thought. According to this perspective, the Soviets lacked the engine that drove science and innovation forward. Many scientific thinkers would have agreed with J. Bronowski's popular 1954 book, *Science and Human Values*, which argued that the "spectrum of values" of a scientific society included dissent, freedom, and independence. Bronowski also claimed: "No one can be a scientist, even in private, if he does not have independence of observation and of thought."[1616] In contrast to the totalitarian societies of the "East," science flourished in the West due to freedom and democracy. Bronowski argued, "The dizzy progress of science, theoretical and practical, has depended on the existence of a fellowship of

[1616] J. Bronowski, *Science and Human Values*, p. 79. See also the popular books of physicist George Gamow.

scientists which is free, uninhibited and communicative."[1617] The book also contained a passage that is bizarre and revealing for Cold War historians:

> By the worldly standards of public life, all scholars in their work are of course oddly virtuous… Individually, scientists no doubt have human weaknesses. Several of them my have mistresses or read Karl Marx; some of them may even be homosexuals and read Plato. But in a world in which state and dogma seem either to threaten or to cajole, the body of scientists is trained to avoid and organized to resist every form of persuasion but the fact. A scientist who breaks this rule, as Lysenko has done, is ignored. A scientist who finds that the rule has been broken in his laboratory, as Kammerer found, kills himself.[1618]

Bronowski argued that science simply could not advance in a dogmatic society that restricted human freedom. He claimed, "The society of scientists must be a democracy. It can keep alive and grow only by a constant tension between dissent and respect, between independence from the view of others and tolerance for them."[1619] Sputnik called these widespread associations into debate.

After Sputnik, it was no longer possible to voice Vannevar Bush's 1949 argument: "The weakness of the Communist state resides in its rigidity to the fact that it cannot tolerate heresy, and in the fact that it cannot allow its iron curtain to be fully penetrated. All these things, vital to totalitarianism… are fatal to true progress in fundamental science."[1620] Totalitarianism should have stunted innovation and progress. Totalitarianism should have hindered and even stop-gagged the great leaps forward. Sputnik should not have happened.

While the extent of a "panic" or a "shock" can be exaggerated, it is important to take these perspectives into account, particularly when analyzing the rush of scientists into the realms of education. As John Rudolf documents in *Scientists in the Classroom:*

[1617] Ibid., 75.
[1618] Ibid., 75-76.
[1619] Ibid., 80.
[1620] Vannevar Bush, *Modern Arms and Free Men*, (New York: Simon and Schuster, 1949), 200.

The Cold War Reconstruction of American Science Education (2002), these efforts involved a fascinating combination of hope and fear.[1621] On the one hand, scientists and science teachers voiced an incredible amount of optimism that the American public could be better trained, not only in the fields of science, but also more generally in the "field" of scientific thinking. With education as a "central plank in their movement," they sought to reform education, thereby reforming the American citizen and (by extension) the American system. The public understanding of science was crucial, because it not only combated public misperceptions but also justified an improved social standing for the scientist, which in turn justified massive centralized funding.

One could more directly add to their motivations: A nationalistic and ideological cause. Many of these educators promoted value-laden justifications for science that fit well with an ideological struggle between the West and East. Rudolph argues, "More important in the public assessment of the nature of science than its incompatibility with totalitarian ideology was its growing identification with democracy."[1622] Again, Rudolph illustrated how many of these associations began in the 1930s. More recent scholarship has pushed the associations between science and democracy even further into the past.[1623] Regardless of the exact origins, it seems clear that, by the early 1950s, many scientists, educators, and intellectuals generally contrasted science/democracy with pseudoscience/totalitarianism. Technology, in their minds, was the ultimate manifestation of applied science, thereby ensuring that the United States was destined to lead the world in modern marvels.

[1621] John Rudolph, *Scientists in the Classroom: The Cold War Reconstruction of American Science Education* (New York: Palgrave, 2002).
[1622] Rudolph, 52.
[1623] See, in particular, Andrew Jewett, *Science, Democracy, and the American University: From the Civil War to the Cold War* (Cambridge: Cambridge University Press, 2012).

To say that Sputnik was "the" shock of the century is an exaggeration. Yet, Sputnik frightened many educated Americans, for legitimate reasons. Having a public and spirited debate about the technological implications was a public duty for both scientists and journalists. This broader discourse was more reflected than engineered in the pages of nearly every popular magazine. Scientific intellectuals expressed outrage. Citizens asked questions. Journalists and experts reported.

By studying the reactions and tactics of Ley, we can glimpse the motivations of a science writer who turned to mass media to educate the American public about Sputnik, while simultaneously exciting them about spaceflight. We can also chart the coexistence of popular hopes and fears. On the one hand, Ley perceived a panic. For the next six months, he campaigned to both educate the American public and debunk the propaganda. Sputnik was an opportunity for public service, just as the Second World War compelled Ley to write "war weapons" articles for *PM*. He enlisted in a fight, and he took his case directly to the public. Like other science writers, he crusaded not only for public awareness but also for a massive effort to catch up with the Soviets. As one of America's most-recognized rocket experts, he influenced millions of Americans to believe in a missile gap with the Soviet Union. In his post-Sputnik writings, a tone of anxiety, urgency, and even fear permeated his articles. He thought in terms of both technological and cultural "lag" with the Soviet Union. On the other hand, Ley continued to excite his readers by glorifying the conquest of space and the scientific discoveries that would follow the launchings of Project Vanguard. He perceived a public hunger for hope, spectacle, and awe. People still wanted news and information about the exciting technological possibilities of the immediate future. Many of his

articles contained few references to the Space Race or the Cold War implications. Instead, he offered a continuity of predictions and prophecies about the dawn of a new era of cosmic exploration. In this sense, his post-Sputnik writings offered an optimistic and hopeful tone to counterbalance fear and anxiety.

Ley's first reactions to the news of Sputnik I are telling. He shared the public's shock and doubt. Nevertheless, as Lester del Ray recalled, Ley "shrugged and went cheerfully on television to calm and explain and offer hope."[1624] For example, on October 6th, he joined a small panel on the CBS television show *Eye on New York*. He made headlines by stating that the United States could have launched a similar satellite as long as a year ago. He added, "but it wouldn't have done much good," due to the lack of a global system of observation.[1625] Ley argued that "we (the United States) have been beaten only in the sense of propaganda value."[1626] According to the *Chicago Daily Tribune*, Ley was also asked if the Russian satellite was made possible "because the Russians had the right German."[1627] Ley responded: "This is almost certainly wrong unless the Germans had rocket experts they didn't know anything about."[1628] Ley spent much of the 1957 and 1958 attempting to debunk this "nonsense."[1629] Ley also appeared on ABC's special report, "The Red Satellite." He similarly argued that the United States

[1624] Lester del Ray, "Credo: The First Citizen of the Moon," *Galaxy*, September 1969, 156.
[1625] "German Gives Russia Full Credit for Satellite," *LAT*, October 7, 1957, 10.
[1626] Ibid.
[1627] Ibid., 18.
[1628] Ibid.
[1629] On debunking the myth of Russian "Germans," see, for example, "U.S. Got Bulk of Data on V-2," *LAT*, November 17, 1957, 23. Ley also continued to assure readers that the United States got the "bulk of data" and top managers related to the V-2 rocket. He noted: "It is still a widespread story that the 'Russians got all the good German rocket engineers.'" Ley countered, "This simply is not true, but it is used as a psychological crutch by many people." See also, Ley, "Myth of German Experts Debunked," *LAT*, May 18, 1958, 27; "What German Rocket Experts Did in Russia," *Philadelphia Bulletin*, May 21, 1958, clipping from the WLC. Ley argued, "To many Americans, this is a much-cherished legend which presumably makes them feel better because it was, at least, not the Russians who produced these spectacular things but the German scientists working for them. And Germany is known to produce scientists."

could have launched a satellite a year ago, yet such an accomplishment was pointless. The only value of the Soviet launch was propaganda.[1630]

Following the launch of Sputnik II, Ley appeared on other television shows. In one program, he attempted to dispel rumors about the Soviets' ability to bring an animal safely back to the earth.[1631] He also suggested that the Russians might attempt to launch a rocket at the moon to inaugurate the fortieth anniversary of the Bolshevik Revolution. He still voiced confidence in American technology, yet his tone became more cautious and hesitant.[1632]

At precisely this moment, Ley joined the *Chicago Sun-Times* as a "Staff Writer."[1633] When the *Sun-Times* announced his "appointment," it ran a full-page display ad that included a portrait of Ley and a satellite hovering above his head. The ad read, "On the Threshold of Space… To keep you authoritatively informed as we enter the Space Age, the Sun-Times is proud to announce the appointment of Willy Ley…" The ad also described Ley as "a noted scientist in the field of rocketry." The details of this arrangement are unknown. Most likely, the *Chicago Sun-Times* contracted Ley for exclusive articles. After publishing his articles first in the *Sun-Times,* the paper would syndicate copies to regional newspapers, like the *Los Angeles Times* and the *Houston Post,* which neither competed with the *Sun-Times* nor each other.[1634] Thus, Ley's articles circulated widely throughout the United States, especially throughout 1958.

[1630] Wayne Phillips, "New Launching Seen Near," *NYT*, October 7, 1957, 1.
[1631] See "A Recovery of Dog Called Possible," *NYT*, November 4, 1957, 8.
[1632] See also, Willy Ley, subsection "How Secret Was Sputnik No. 1?" in "The First Spaceship," *Galaxy*, November 1958, 48-50.
[1633] For the announcement, see *CS-T*, November 17, 1957, 14.
[1634] Many of the following quotes come from the *Los Angeles Times*, solely due to their accessibility through Proquest. These articles were widely distributed in other newspapers throughout the United States.

According to a "short biography" by toy-maker Monogram, these (sometimes daily) articles were syndicated "to more than 100 newspapers."[1635]

When Ley had something to say about rockets, hundreds of thousands of Americans read his words. Not only were these articles distributed in newsprint, but several also ran in the magazine *This Week.*[1636] Additionally, Ley's pieces were so popular that New American Library collected many together into a paperback book for mass consumption. With a price tag of thirty-five cents, *Satellites, Rockets, and Outer Space* gave Ley's articles a wider readership.[1637]

Ley's first series for the *Sun-Times* was titled, "Missiles, Moons, and Space Ships." Topics ranged from "What Will Invaders From Space Look Like?" to "Von Braun was Rocket Pioneer!"[1638] On the one hand, these articles continued to voice optimistic predictions about the American conquest of space. Perhaps his boldest prediction asserted: "There can be no doubt that in a decade or two there will be manned bases on the moon and at least one on Mars."[1639] Other predictions outlined the imminent series of steps that would lead from satellites to a manned space station. Ley argued, "Within ten or twenty years space flight will be an almost everyday

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[1635] "Special Willy Ley Issue," *The Monogram*, February 1959, 1.
[1636] "Rocket Expert's Space Series Starts Today," *LAT*, November 10, 1957, 1.
[1637] Willy Ley, *Satellites, Rockets, and Outer Space* (New York: New American Library, 1958).
[1638] See Willy Ley, "What Will Invaders From Space Look Like?" *LAT*, November 10, 1957, K17; "Moons and Missiles: U.S. Writer Launched Satellites Idea in 1870," *LAT*, November 11, 1957, 2. "Moons and Missiles: Von Braun Was Rocket Pioneer," *LAT*, November 14th, 1957, 2; "Moons and Missiles: Rocket Terms Need Defining," *LAT*, November 15, 1957, 12; "Moons and Missiles: U.S. Got Bulk of Data on V-2," November 17, 1957, 23; "Moons and Missiles: Space Science Pleas Ignored," *LAT*, November 18, 1957, 14; "Moons and Missiles: Space Venture Steps Outlined," *LAT*, November 19, 1957, 23; "Moons and Missiles: Laws Needed for Space Age," *LAT*, November 20, 1957, 17; "Moons and Missiles: Crew of Space Ship Described," *LAT*, November 21, 1957, 26; "Moons and Missiles: Drones Likely to Test Planets," *LAT*, November 22, 1957, 26. Ley continued to write other articles, such as "Rocket to Moon Called Feasible," *LAT*, December 8, 1957, A; "Soviets Seen Far Ahead in IRBMs," *LAT*, December 15, 1957, 15.
[1639] Willy Ley, "Commerce of the Skies," in *Satellites, Rockets, and Outer Space*, 107.

occurrence."[1640] Ley also predicted, "Some five or six years from now an enormous rocket will roar into the sky."[1641] It would carry 5 or 6 American astronauts into space. In a different article, Ley predicted that "If we visualize a well-planned and well-co-ordinated Operation Outer Space the first orbital flight of a manned ship looks as if it were six or seven years in the future."[1642] Overall, he claimed, "Space travel will follow as naturally as air travel followed man's first winged flights."[1643] Allegedly, Ley also forecasted the future for the attendees of an annual charity event. A journalist noted, "Interplanetary travel will become so commonplace, commuters may find it a bore, Willy Ley, rocket expert said yesterday."[1644] Ley never missed an opportunity to promote von Braun as the man who could make this reality come true.

On satellites, Ley continued to celebrate the scientific and technological possibilities.[1645] Throughout 1958, Ley predicted television, meteorological, and communications satellites within the next two years.[1646] Ley argued that satellites would usher in a "new communications era," when "messages which came from the United States will be released on demand" around the world.[1647] He also outlined two

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[1640] Ley, "What Will Invaders From Space Look Like," *LAT*. This article also appeared as "What Will Space People Look Like?" *This Week Magazine*, November 10, 1957. It later made an appearance in the February 1958 issue of *Science Digest*.
[1641] Willy Ley, "Plans for Space Station Outlined," *LAT*, January 12, 1958, 24. According to a reporter in the *Chicago Daily Tribune*, Ley made a similar prediction at a Philadelphia event in February of 1958. See "Plan Bigger, Better U. S. Moons Soon," *CDT*, February 4, 1958, 5.
[1642] Ley, "Moons and Missiles: Space Venture Steps Outlined," *LAT*, November 19, 1957, 23.
[1643] Willy Ley, "A Two-Year Look into Space," *The Rotarian*, October 1958, 56.
[1644] Mary Middleton, "Women Plan May Benefit for Hospital," *CDT*, March 25, 1958, A4.
[1645] Ley made these satellite predictions in different venues. For example, in March of 1958, he addressed scores of aspiring high school journalists and editors at the 34th annual Columbia Scholastic Press Association convention. An estimated 5,000 aspiring journalists and their faculty advisors gathered for the event in the Grand Ballroom of the Waldorf-Astoria Hotel. According to the *New York Times*, Ley predicted the launch of a television satellite that would "broadcast a picture of the earth to the earth." See "Scholastic Press Meets This Week," *NYT*, March 9, 1958, 49.
[1646] Willy Ley, "TV Satellite For Weathermen Seen," *LAT*, February 23, 1958, A1.
[1647] Willy Ley, "How Satellites Will Bring New Communication Era," *CS-T*, December 21, 1958, clipping from WLC, page unknown.

"methods" which could be used to launch a satellite to the moon in 1958.[1648] He wrote: "One doesn't have to be a prophet to predict that there will be a shot to the moon this year. Nor does one have to be a cynic to say that there will probably be two—one American and one Russian."[1649]

During this time, Ley also claimed that the "first moon trip" could happen as early as 1965.[1650] Whereas earlier predictions saw the establishment of a space station as a necessary precursor to a moon voyage, Ley argued, "We must have a piloted ship capable of going into an orbit. But the trip around the moon – as distinct from a landing on the moon—doesn't have to wait for the establishment of a space station."[1651] He concluded the article by minimizing the difficulties of the venture: "What needs to be done is just the development of a piloted ship that can go into an orbit. This is on the program anyway and therefore the first trip around the moon is a predictable affair."[1652] In some articles, he argued that the moon should be "Target No. 1."[1653] Yet, other articles continued to promote von Braun's space station.[1654] Reporters eagerly informed the public of his predictions of a "space station, a red, white, and blue one."[1655]

In many articles, Ley also promoted the future "passenger liner." In an article for *The Rotarian,* Ley celebrated the "point to point" rocket flights that will be "manned

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[1648] Willy Ley, "A Shot to Moon This Year? Here Are 2 Methods," *CS-T*, March 2, 1958. See also, Ley, "1958 May Be Year Of Cluttered Sky," *LAT*, March 2, 1958, 30.
[1649] Ibid.
[1650] Willy Ley, "First Moon Trip By 1965 Possible, *LAT*, March 16, 1958, 22. The *Los Angeles Times* ran a second edition of this article. See Willy Ley, "Moon Trip Forecast Within Seven Years," *LAT*, March 21, 1958, 20.
[1651] Ibid.
[1652] Ibid.
[1653] Willy Ley, "Moon Should Be First Target…" *CS-T*, March 8, 1959.
[1654] Ley, "Moons and Missiles: Space Venture Steps Outlined," *LAT*, November 19, 1957, 23. He added, "No iceberg would escape unnoticed, no ship would drift helplessly any more without its position being made known to rescue forces. Any airliner flying across uninhabited areas could be watched."
[1655] "Expert Expects Manned Space Station by '65," *LAT*, February 24, 1959, D19.

and peaceful.'[1656] The text offers readers a glimpse of their immediate future as they imagine a flight from New York to London: "You have traveled for one hour and 15 minutes, with less than four minutes of it under acceleration. With some trouble you straighten up and walk to the covered escalator… Just beyond the horizon there is London."[1657] Ley made other predictions while informing readers about American progress in the space race.[1658]

In spite of so much optimism, hope, and confidence in the immediate conquest of space, his articles also displayed a growing sense of anxiety and fear, which increased with each Soviet success in space. Initially, he expressed these feelings in nationalistic terms. For example, he wrote, "For most people, the Age of Space dawned Oct. 4, 1957, when Russia's Sputnik began beeping from the sky. Yet the first rocket in all history to climb above the earth to a height of 250 miles was fired on Feb. 24, 1949. And the place was the United States White Sands Proving Ground in New Mexico."[1659] In spite of American "firsts," Ley began to think in terms of cultural "lag." It started with a comparison of the public reception of Goddard and Oberth. Goddard's original treatise "was received with a small amount of ridicule," and it generated no noticeable scientific debate, Ley argued. Conversely, Oberth's work "was received with complete seriousness… And it started things going on an international front."[1660] This comparison

[1656] Willy Ley, "Rocket to London," *The Rotarian*, January 1958, 40-43.
[1657] Ibid., 43.
[1658] See Willy Ley, "Test Proves Space Travel, Ley Says," *LAT*, February 19, 1958, 9; "Ley Analyzes Failure of 2nd U.S. Satellite," *LAT*, March 12, 1958, 18; "Space Talk Mad Easy For Reader," *LAT*, April 13, 1958, 26; "Satellites' True Speed Variable," *LAT*, April 27, 1958, 26; "Vanguard Use of 3 Fuels Explained," *LAT*, May 4, 1958, 24; "Atlas Designed to Lift 200,000-Pound Weight," *LAT*, June 8, 1958, 26; "What To Do With Atomic 'Garbage', Ley Would Send Waste to Sun," *Denver Post*, November 14, 1958, clipping in WLC.
[1659] Ley, "Moons and Missiles: U.S. Writer Launched Satellites Idea in 1870," *LAT*, November 11, 1957, 2.
[1660] Ley, "Idea of Rockets Mocked, Hailed," *LAT*, November 13, 1957, 2.

led Ley to imply that the negative public reaction in the United States stunted the field of American rocketry.[1661] He took this argument further: "We could be far ahead of the Russians if there had been more imagination…"[1662] Ley's views on the role of imagination can be related to Stephen J. Pyne's summary of the viewpoint that the "only impediment… is imagination, as translated into political will, expressed as money."[1663] In "Space Science Pleas Ignored," Ley made the case directly by lamenting the fact that American scientists faced ridicule and institutional discouragement during the previous decades. "America snubbed her scientists," the headline argued.[1664] In general, scientists "were told to take their science fiction plots home with them."[1665] Then, according to Ley, "we lost the largest propaganda battle of the cold war" because of the "bad impression" of using a military rocket to launch a satellite. The decision to use Vanguard instead of Orbiter was a fatal mistake. He argued that "we would probably have an unmanned rocket on the moon right now," if they have given von Braun the green light.[1666]

Then, Ley made his most direct assault on "official explanations." He began by undermining the claim that the United States had never been in a "race" with the Soviet Union. "This might possibly be true," Ley admitted, "but everybody else on this planet

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[1661] A specific article on Goddard prompted G. Edward Pendray to write an angry letter to Ley, claiming that he was misrepresenting the reclusivity of Goddard. This started a brief and nasty back-and-forth with the editors of the *Chicago Sun-Times*. In a letter to the editor, Ley wrote, "As for myself I had never seen Goddard's book before my arrival in the United States." Pendray lashed back, claiming that Ley was the chief architect of a German conspiracy to diminish the contributions and legacy of Goddard.
[1662] Ley, "U.S. Got…"
[1663] Stephen J. Pyne, "Seeking Newer Worlds: An Historical Context for Space Exploration," in *Critical Issues*, 8.
[1664] Ley, Willy, "America Snubbed Her Scientists," *Birmingham Post and Gazette*, November 23, 1957, page unknown.
[1665] Ley, "Moons and Missiles: Space Science Pleas Ignored," *LAT*, November 18, 1957, 14.
[1666] Ibid. Incidentally, Ley wrote this article, as well his feature article on von Braun a few days after writing to von Braun to say, "In spite of the sputnik cocktails being served (one part vodka, two parts sour grapes) the space age has now dawned. Your place in it is still at apogee." Quoted in Neufeld, *Von Braun*, 311.

was convinced that we were in a race and the whole world says we lost it…"[1667] He asserted: "We have suffered a totally unnecessary loss of international prestige and I feel that a citizen can expect of his planners that they keep such minor matters as prestige in mind… We have lost a major propaganda battle."[1668] Whereas Ley downplayed this propaganda victory in early October, he now stressed its global importance.

During this time, Ley also attended several "youth forums" in New York City, where he gave talks, such as "What Is Man Seeking in Outer Space?" A specific youth forum was televised.[1669] In this event, Ley argued that the United States did not lag behind the Soviet Union in terms of general science. Rockets were a different story. A journalist reported, "Mr. Ley… said the United States was behind by at least a year in artificial satellite work and in the development of missiles of intermediate (1,500-mile) range."[1670] There was a missile gap. This broadcast re-aired on November 30th.

On December 6, 1957, the attempt to launch Project Vanguard failed when the rocket fell to the launch pad. Ley recalled the aftermath for the readers of *Galaxy*: "…I was subjected to more than the customary number of radio, television, and newspaper interviews, not to mention countless private questions. They all dealt with Vanguard, which has just suffered the most publicized failure of any rocket."[1671] Ley added, "And since everyone had been whipped into expecting wonders of Vanguard, the disappointment was obviously severe. Under normal conditions, the failure would have

[1667] Ibid.
[1668] Ibid.
[1669] "Television Programs," *NYT*, November 24, 1957, 148.
[1670] "5 Youths Define Race for Space," *NYT*, Nov 25, 1957, 15.
[1671] Willy Ley, "For Your Information: IGY Roundup," *Galaxy*, July 1958, 56.

been just a plain failure."[1672] Ley apparently overlooked his own contributions to the optimism surrounding Vanguard.[1673]

At the same time that analyses of the failure spread throughout the press, so too did a different article by Ley: "Some Implications of the Sputniki." It was published in the *National Review*.[1674] Ley began by commenting on so many contradictory accounts. "Ever since Sputnik No. 1 took up its orbit around the earth," he argued, "thorough newspaper readers must have been thoroughly bewildered by the headlines they could read in succession." He joked, "One read: 'Sputnik's Meaning: 'Catch Up Or Die' Says Rocket Engineer.' He was immediately fired from his job. Another one was 'Just a Silly Bauble Says Presidential Advisor.' He was not fired."[1675] Ley then tried to set the record straight by debunking false rumors, such as the notion that Sputnik could "spy" on the United States. The Russian satellite itself had no direct military value. However, Ley argued, "The military significance of the Sputniki is in the rockets that launched them."[1676] He presented the facts to the best of his knowledge. The Russian had a 1,500-mile rocket. "We do not," Ley emphasized. The Russians are testing 4,000-mile-range missiles. Ley speculates, "We may have; the public has not been told." Ley concluded, "Our job is very simply to catch up with the Russians. This may not be easy by any means but it can be done. But there is no way of erasing the loss of prestige we suffered. All one can hope for is that it may be overshadowed by later events."[1677] Ley made a

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[1672] Ibid., 57.
[1673] Ley was forced to revise his *Man-Made Satellites*. He remarked, "Thus the year 1957 closed without seeing an American artificial satellite in the sky." He still described Project Vanguard as "Earth's first artificial satellite." See Willy Ley, *Man-Made Satellites* (Poughkeepsie, NY: Guild Press, Inc, 1958), 7-9.
[1674] Willy Ley, "Some Implications of the Sputniki," *The National Review*, December 7, 1957, 515-516.
[1675] Ibid., 515.
[1676] Ibid., 516.
[1677] Ibid.

similar statement in a widely-syndicated article titled "Soviets Seen Far Ahead in IRBMs."[1678]

Throughout much of 1958 and 1959, Ley educated Americans about Soviet rockets and satellites.[1679] Not only did he explain the known facts, but he also attempted to debunk irrational fears and false rumors.[1680] At other times, Ley combated "reasoning without fact" or public irrationalism.[1681] Regarding Russian claims, Ley usually added a cautious word on Russian announcements, which indicated a consistent distrust of Soviet claims.[1682] He reluctantly credited the Russians with many "firsts," even the launch of a "liquid fuel research rocket" between 1935 and 1937.[1683] He added, "The mystery is not that they did it but that they kept it a secret. Otherwise the Russians have been rather ready to brag about all of their 'firsts,' even to the extent of claiming a few which certainly were not theirs."

[1678] Willy Ley, "Soviets Seen Far Ahead in IRBMs," *LAT*, December 15, 1957, 15.
[1679] See Willy Ley, "When Did Russians Start Work On Rockets?" *CS-T*, January 12, 1958, 16. This article also appeared in the *Los Angeles Times* as "Russ Didn't Need Nazi Rocketeers," January 26, 1958, 38. See also, Willy Ley, "How Sputnik I Came To Be," *CS-T*, Jan 8, 1958, clipping from WLC. On Sputnik I's demise, see "Meteor Threat To Satellites Small," *LAT*, February 9, 1958, 25; Ley, "What Happened to Sputnik I?" *Detroit Michigan News*, February 3, 1958, page unknown; "New Russian Breakthrough Expected during Mr. K Visit," *LAT*, September 15, 1959, 2. See also, Willy Ley, "The Orbit of the Vanguard Satellite," *Galaxy*, March 1958, 71-85; subsection "The First Russian Research Rocket," *Galaxy*, June 1959, 104-105; "The Atlantic Missile Range," *Galaxy*, April 1959, 69-83; "Any Questions?" *Galaxy*, October 1958, 81-83.
[1680] On the debunking of rumors, see Willy Ley, "First Moon Shot Due July Fourth? It's Merely Cocktail Party Rumor," *LAT*, June 1, 1958, 37. In "A Space Mirror for War? It Can't Be Done," Ley casually recalled a conversation with a fellow airplane passenger, who said, "The Russians are reducing their armies because they plan to use space mirrors… they'll burn cities and blow up ammunition dumps. Awful!" Ley used the opportunity to finally put this old idea to rest by arguing, "the laws of nature see to it that this simply cannot be done." See Willy Ley, "A Space Mirror For War? It Can't Be Done," *CS-T*, February 16, 1958, clipping in WLC. See also, Willy Ley, "Scientific Reminder: We Can't Buy Miracle, " *LAT*, April 6th, 1958, 30. He also took an opportunity in the pages of *Fate* to debunk the rumors that Russians had a "new and marvelous fuel." See Ley, "The Ion Space Drive," *Fate*, June 1958, 30-39. Additionally, Ley recalls much of these debunking efforts in *Rockets, Missiles, and Men in Space* (1968), 315-323.
[1681] This style of newsprint writing began in late 1957 with a series of articles meant to debunk UFOs. See Willy Ley, "Things in the Sky: 'Flying Saucers' Stirred All U.S.," *LAT*, December 16, 1957, 7; "'Saucer' Reports Tracked Down," *LAT*, December 17, 1957, 12; "'Saucers' Hunt Proves in Vain," *LAT*, December 18, 1957, 12; "Saucers! Errors or Phenomena?" *LAT*, December 19, 1957, 22.
[1682] Willy Ley, "Willy Ley Analyzes Aspects of Space Jaunt," *LAT*, January 7, 1958, 12.
[1683] Ley, "When Did Russians Start," 16.

In his view, the Russians were leading the way into space simply because they "just went to work" earlier than the Americans.[1684] This work had many frontlines. For example, Ley commented on a radio interview, in which someone said, "I bet the Russians can't just go to a library and read all about the latest rockets."[1685] Ley investigated the Russian literature. To his surprise, he found that several notable German and French books had been translated into Russian. In contrast, there were no English equivalents. Ley announced, "We ought to get busy and do some translating ourselves. Other people have ideas, too!" Americans should have been less complacent and more internationally minded.

Increasingly, Ley also discussed the military potential of spaceflight technologies.[1686] For example, in "Conquest of Space Vital For Nation," Ley argued the Russians "could prevent us from using space if they got there first."[1687] Space superiority meant that the Soviet Union "could do as it pleased over enemy territory."[1688] Ley pleaded, "While in the long run, the purpose of the space station is peaceful and devoted to research and progress, the immediate and urgent purpose is to establish space superiority."[1689] The space station would give the United States a strategic advantage over the Soviet Union. It would also provide a base that might launch missiles of its own. After ruminating about the possible advantages of a space station in wartime, Ley concluded, "The lesson of all this is clear and simple… We cannot afford not to have space superiority. Fortunately the space station also offers the

[1684] Ibid.
[1685] Willy Ley, "Russia Provides Rocketry Books," *LAT*, April 20, 1958, 26.
[1686] See for example, Willy Ley, "Solid Rocket Fuel Seen Taking Lead," *LAT*, February 2, 1958, 22.
[1687] Willy Ley, "Conquest of Space Vital For Nation," *LAT*, January 5, 1958, 24.
[1688] Ibid.
[1689] Ibid.

promise of new discoveries and, since discoveries very often pay off commercially, it is rather likely that the money spent for space superiority will actually be an investment."[1690] Spaceflight would either pay for itself or result in enormous dividends.

Ley also continued to popularize notions of cultural "lag" and some degree of "missile gaps" in many public appearances.[1691] For example, he told an audience at Los Angeles State College, "We are lagging behind Russia."[1692] If the Russians soon accomplishment more victories, "it is to be expected…"[1693] The *Los Angeles Times* reported on Ley's perspective during a visit: "The inconsistency of a powerful country, one of whose citizens built and launched the world's first liquid fuel rocket, being nominally two years behind Russia appalls him."[1694] The newspaper quoted Ley as saying, "The reason Russia is two years ahead of us is because of a difference of approach. We waited until a hydrogen warhead had been reduced in size sufficiently before we went ahead with a missile to carry it." Ley added, "Unfortunately, the United States is perpetually cursed with official thriftiness… Naturally, I favor democracy, but sometimes it is too flexible. We need longer terms for our office-holders to give a continuity of effort."[1695] He allegedly stated, "Can we catch up with the Russians? Nobody ever said we can't, but nobody ever said it will be easy. When will we reach the moon? My dear fellow, I am an expert but I am not a prophet."[1696]

[1690] Ibid.
[1691] His schedule and competing responsibilities had grown quite hectic. In an article for *Galaxy*, Ley had to announce, "I do not – repeat NOT – promise to answer by mail." See Willy Ley, "Note to Correspondents," *Galaxy*, October 1958, 61.
[1692] Ley, "Expert Expects…" *LAT*, February 24, 1958, D19.
[1693] Ibid.
[1694] Gene Sherman, "Willy Ley Appalled by U.S. Rocket Lag," *LAT*, May 4, 1959, B5.
[1695] Ibid.
[1696] Ibid.

His most direct summary of his lecture tours can be found in his introduction to Albert Parry's *Russia's Rockets and Missiles* (1960).[1697] He wrote, "I do hope that Professor Parry's work will help to answer a question from the public, which I have been asked innumerable times since October 1957. It might be useful to explain that I spent about half the time that has gone by since the date of Sputnik I in lecturing all over the United States."[1698] Ley added, "I probably met more 'public' than anybody who is tied down to a routine job, even if that routine job should be that of a newspaper reporter."[1699] Ley then presented the public's central question as "How could the Russians…?" Ley summarized his "simple" answer, given countless times at public lectures and forums: "If you round up, say, one million people anywhere this 'sample' will contain so-and-so many geniuses… Add to this a government which has a goal and purpose… the bright boys and girls will get a chance to show just how bright they are and what they can do."[1700] Ley then summarized the reaction of the crowd, which "may sound incredible, but it was actually advanced not just once or twice, but many a time." A person usually responded, "But… but we have never heard of any Russian geniuses." Ley answered, "They are just not known to the American public because they suffered from the drawback of being scientists."[1701] Regarding Parry's book, Ley added: "I hope this information will contribute to ending the nice cozy nap from which so many do not wish to be awakened."[1702] At other times, Ley simply explained the "secret" of

[1697] See Albert Parry, *Russia's Rockets and Missile* (London: Macmillan and Co., 1960).
[1698] Willy Ley, "Introduction," in Parry, 10.
[1699] Ibid.
[1700] Ibid.
[1701] Ibid.
[1702] Ibid., 11.

Russsia's success: "The secret, I kept repeating, was that the Russians had bigger rockets… I hope that at least a few people believed me."[1703]

Although Ley's anxieties permeate many of his articles and lectures, Ley also offered readers and audiences reasons to hope. For example, in *The Rotarian*, Ley asked "Who Owns Space?"[1704] He reassured the public that a Soviet flag on the moon had no legal standing.[1705] In other articles, Ley offered readers some reasons to hope that the Russians might be falling behind, while the United States lessened the missile gap.[1706] He saw positive signs in late 1958 when Vanguard's career was "ending."[1707] With the creation of NASA, Ley predicted a new rocket that "will resemble the present Vanguard in name only."[1708] Ley also favorably contrasted American and Soviet developments, by arguing, "American scientists will not send up a man until they're sure they can get him back safely—while the Russians probably won't be too concerned over the fate of the man."[1709] Despite his anxieties about the Soviet Union, he still offered readers many reasons to be excited about the future.

Models and Displays

[1703] Willy Ley, *Rockets* (1968), 323.
[1704] Willy Ley, "Who Owns Space?" *The Rotarian*, June 1958, 10-13.
[1705] Ibid., 13.
[1706] For example, in "Sputnik III is Dual Type of Satellite," Ley speculates about Russian delays that may explain why the third satellite was not a "shot… to the moon." See Ley, "Sputnik III is Dual Type of Satellite," *LAT*, May 25, 1958, A22. He argued, "If the Russians wanted to keep up the news value, a moon shot was logical for the third, but instead they shot another satellite, thereby increasing our chances for a first try for the moon."
[1707] Willy Ley, "Vanguard Career is Ending; New Missile May Use Name," *CS-T*, October 12, 1958, clipping from WLC, page unknown. He wrote, "The story of the original Vanguard bears a strong resemblance to the play which went beautifully through several rehearsals but fell to pieces just as soon as the audience was present."
[1708] Ibid.
[1709] "Expect Reds to Put Man in Orbit First," *Daily Defender*, February 25, 1959, 2.

Ley's tactics were not confined to television appearances, public lectures, and print media. In early February of 1958, he helped to organize a "space exposition" on the 8th floor of the New York department store Abraham & Straus. This public exposition may be one of the most understudied events of the Space Age. The vice president of the company told a reporter, "We think this is the biggest, most comprehensive public space show in the country—I don't know about the world."[1710] The *New York Times* described a mesmerizing scene of "rockets, models of rockets, rocket engines, space suits, unborn space ships, and similar intergalactic gadgets."[1711] The exposition also included a cutaway of the combustion chamber of a V-2 rocket, a "mock-up" of a "Navy Stratolab balloon gondola," and a "scale model of the Jupiter-C rocket."[1712] Obviously, the space exposition capitalized on the successful launch of Explorer I. The vice president remarked, "Even if the Army hadn't fired the Explorer by now, we'd have opened the show on schedule… It took more than three months to prepare. But, we're glad the Army cooperated down in Florida."[1713] When the show opened, "scores of school children" entered the store with their teachers and parents. This exhibition celebrated post-Sputnik American accomplishments. Most likely, the event excited the children and reassured the adults.

Not only did Ley bring children and adults to space models on display, but he also brought space models into the homes of hundreds of thousands of American children. In early 1959, Ley entered into association with toy-maker Monogram to serve as a consultant to a line of space models. Monogram announced this association with

[1710] "Space Exposition Is Staged In Store," *NYT*, February 5, 1958, 11.
[1711] Ibid.
[1712] Ibid.
[1713] Ibid.

great optimism about the future. Its newsletter read, "Because we firmly believe that the public is not only space conscious, but also thirsty for space knowledge, it is my considered opinion that Monogram has taken a GIANT STEP forward in our association with Willy Ley."[1714] The announcement added, "Impatient customers want 'authentic' space models NOW!"[1715] The announcement also boasted of Ley: "No idle dreamer, he, but a man with deep conviction, one of the few scientists who, throughout the years, has been expounding the philosophy of space and space travel."[1716] As such, Monogram's new models would offer revolutionary glimpses into the future, when "there will be an entirely new concept of life and of living."[1717]

Monogram then showcased four authentic "new and timely space models," as designed by Ley. They included the "T. V. Orbiter," the "Orbiter Rocket," the "Passenger Rocket," and the "Space Taxi."[1718] Each of these models had a price tag of less that $1.50. Monogram argued, "They will feed the thirst that is being created hourly in the minds of millions of people, young and old, all over the world."[1719] The newsletter encouraged its distributors to jump onboard: "All of us in this business have one of the greatest selling opportunities the model and the hobby field has ever known."[1720] Monogram elaborated on its massive advertising campaign to promote the models in newspapers and magazines, as well as on television and radio. "The entire nation," monogram announced, "is being told about Willy Ley and his connection with

[1714] "Special Willy Ley Issue," *The Monogram*, February 1959, 1.
[1715] Ibid.
[1716] Ibid., 3.
[1717] Ibid.
[1718] Ibid.
[1719] Ibid.
[1720] Ibid.

Monogram Models…"[1721] In a later newsletter, Monogram claimed that a day scarcely went by without a "space conscious America" seeing their models on television, hearing about them on radio, or reading about them in magazines and newspapers.[1722]

The announcement offered further proof of sales potential by quoting a retailer who argued, "People are usually very interested in the future and the Willy Ley name seems to make them unusually real."[1723] A public relations man also claimed: "Mr. Ley is quite a personality, and I might add, quite a celebrity. Because of the nature of his models and their value as disseminators of information and a better understanding of what is to come in the space age, many publicity channels have been opened to us." An advertiser agreed by stating, "They represent a new era in human existence and have a tremendous educational value for adults and youngsters alike."[1724]

As this publicity campaign unfolded, Ley made a *Blitzkrieg* of media appearances on radio and television, and he appeared as a guest of honor at the industry's annual trade show. He enthusiastically promoted his space models, offering many reasons for their educational value. During a visit to Los Angeles, Ley claimed, "The best way to learn is by doing, and that's what makes the space models that are becoming so popular very worth while. To-day's children don't have to unlearn things before they can understand what we're talking about. A child accepts an explanation of space travel, an adult argues about it."[1725] Ley also used his connection with the *Chicago Sun-Times* to promote the Monogram models. The supplemental Sunday magazine, *Sunday Midwest*, ran a full-page story that took readers on a trip to the moon

[1721] Ibid.
[1722] "Willy Ley Space Models," *The Monogram*, May 1959, 2.
[1723] Ibid., 4.
[1724] Ibid.
[1725] Gene Sherman, "Willy Ley Appalled by U.S. Rocket Lag," *LAT*, May 4, 1959, B5.

in a future vehicle based on Ley's designs.[1726] Monogram soon also published a "Space Age News Letter," edited by Ley.[1727]

By late 1959, Monogram could proclaim success in their advertising campaign. Inside the October flyer, Ley reflected, "Perhaps slow at first to catch on… I am now glad to report that the models have steadily grown in popularity, and tremendous numbers of them are being sold, in every part of the nation and in other countries as well."[1728] Ley attributed the popularity of the models to their accuracy of design. He claimed, "I designed them with the full force of facts and research findings at my command and proceeded as I would if I were designing a real space vehicle, for actual space travel."[1729] Incidentally, Monogram began to promote a "4-kit Gift Package" for the Christmas season. Ley argued, "These kits represent delightful fun beyond comparison; provide the means to fascinating space development study; give a better understanding of space travel than you can obtain in any other way." By constructing the space models, children would participate in the imminent conquest of space.

Disney in the Classroom

In addition to bringing space models into the homes of children, Ley spent much of 1959 bringing Disney's earlier lessons into the classrooms and libraries of American public schools. His small and lavishly illustrated books were based on Disney's

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[1726] "Willy Ley Describes Your Flight to the Moon," *Sunday Midwest*, July 12, 1959, 9.
[1727] Premiering in October of 1959, this newsletter introduced readers to the astronauts chosen for Project Mercury. The newsletter also speculated on "what the well dressed spacemen will wear." The issue then promoted the "Space Explorers," a club that gave its members an autographed photo of Ley. The newsletter asked, "Are you interested in space—in missiles—in travel to other planets? Are you curious about what is going on in the Space Age development all around you? Are you excited about the possibility of man going into space and returning to tell you about his experience? Then you should be a Space Explorer." See *Space Age News Letter*, ed. Willy Ley, October 1959, 1.
[1728] "Monogram Space Models Lead in Hobby Kit Popularity!" in *Space Age News Letter*, 3.
[1729] Ibid.

spaceflight programs and "adapted for school use." Ley's work in this regard began with *Man in Space* (1959), a 48-page book aimed at young readers.[1730] It contained many of the familiar themes of his Sugar Jets books. It also relentlessly promoted von Braun and his designs. Ley argued, "One day this four-stage rocket will be ready."[1731] While dramatic illustrations depict the first manned flight, as well as a "space walk," Ley's text again tried to depict the event as routine engineering. Regarding the problem of re-entry and landing, he wrote: "When the ship is within the earth's atmosphere it will be flown just like an airplane. It is now simple to aim for the base and its runway… Then touchdown. The first orbital flight is over."[1732] This tactic of combining dramatic descriptions and simple explanations of routine technological feats had become a staple of Ley's texts.

His other contributions are interesting. For example, *Mars and Beyond: A Tomorrowland Adventure* teaches young readers about the future conquest of the red planet. [1733] Ley wrote, "Some fifteen years in the future, powerful telescopes will be able to spot a strange structure orbiting around the earth: the first Mars ship."[1734] The book also made the case for a large expedition, similar to the ambitious designs of von Braun that aired on television. Ley wrote, "A fleet of ships would be best for an

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[1730] Walt Disney Productions, *Man in Space* (adapted for school use by Willy Ley) (Syracuse, NY: L.W. Singer and Company, Inc., 1959). See also *Tomorrow the Moon* (adapted for school use by Willy Ley) (Syracuse, NY: L.W. Singer and Company, Inc., 1959); *Man and Weather Satellites* (Syracuse, NY: L.W. Singer, 1959).
[1731] Ley, *Man in Space*, 35.
[1732] Ibid., 48.
[1733] Walt Disney Productions, *Mars and Beyond: A Tomorrowland Adventure* (Syracuse, NY: L.W. Singer Company, Inc., 1959). The book contained a foreword, in which Walt Disney argued, "...we tell the story of how man may someday explore Mars and what he might expect to find. From Mars, man may possibly move farther out into space, to the more distant, even more mysterious planets. "Disney's attempts to bring Tomorrowland into American schools can be seen in other texts: See Heinz Haber, *The Walt Disney Story of Our Friend the Atom* (New York: Dell Publishing Co., 1956); Walt Disney Productions, *Man in Flight* (adapted for school use by Jane Werner Watson) (New York: L.W. Singer Company, Inc., 1959).
[1734] Ibid., 11.

expedition to Mars."[1735] Unlike the more modest trip in *The Exploration of Mars*, Ley describes a massive convoy of umbrella-like space ships that function on atomic reactors. Once they arrive at Mars, they launch "landing boats," which parachute down to the surface as reaction rockets slow their descent. This adventure is the only way that scientists will solve the mysteries of Mars. Human beings had to get there and look around. The book concluded with a glimpse into the future, when Americans have colonized Mars. Colonization is a matter of routine. Man will simply "leave the caves and build domed cities on the open plains."[1736] It would be an easy and routine affair.

Looking In from the Outside

During a *Night Beat* interview in 1957, journalist Mike Wallace asked several final questions, including the following inquiry: "Willy, as a science reporter, how much do you yourself really know about missiles, in the face of the military security which is put about them?"[1737] Ley answered, "Eh… that depends on what part you look at. If you look at the question of propulsion, not very much is secret, as far as I know. If you look at guidance, practically everything is secret." Despite this secrecy, Ley made the case that much of the secrecy has been "overdone." He gave an example of reading recently declassified documents. He joked, "No amount of questioning could make me think of a reason why they should have ever been classified in the first place." He felt confident of his knowledge as an outsider.

Wallace then asked one last question: "Seriously, or more seriously, we should say on this one: Up to the time you left Berlin, you were among the most promising

[1735] Ibid., 20.
[1736] Ibid., 48.
[1737] *Night Beat*, 17:00.

rocket research scientists. Today, you're on the outside. You're writing about scientists. You worked with them. Do you ever feel that you are missing out on the really creative work?" Apparently, none of Ley's activities counted as the "really creative work" of the Space Age. Ley understood the sentiment behind the question: "Yes," Ley admitted, "but I have a good substitute… if I were engaged in actual research work, I would be engaged in one small field. As a science writer, looking in from the outside, I can watch simultaneously a dozen interesting fields." Ley's tone of voice indicated his firm conviction that the outsider could be an expert. In fact, the outsider could become a true expert, seeing from a public vantage point. Conversely, the specialists could be lost in isolation. There were additional obstacles of military secrecy and inter-service rivalries.

At the end of the interview, Wallace thanked Ley for the interview, before speaking to the audience: "Somewhere between us and the scientific mind stands Willy Ley, always curious, and always ready to translate the complex into clear, understandable, but still highly adventurous terms. We hope that when the first rocket ship reaches the moon… Willy Ley will be aboard, and we'll bring back [to] *Night Beat*, as a guest: a genuine, bona fide moon man."

If historians wish to understand both the public hopes and fears throughout 1957 and 1958, then it is crucial to recognize the powerful influence of a science writer who worked outside of the walls of an institution. Willy Ley had little inside knowledge of American missile programs and the true nature of the Space Race. Yet, in 1957, he was seen as one of America's leading rocket experts. He was also a media insider. Journalists and citizens turned to him for answers and predictions. Both before and after the Sputnik moment, he took every opportunity to excite his audiences, whether they

were attendees of an annual meeting or curious children reading with flashlights in beds. His works document not only the popular excitement and expectations of an American future in space but also the fears and anxieties that rise to the surface of space-related media. He influenced the perspectives of millions of Americans who embraced a vision of the future with its corresponding and optimistic expectations. More than many other figures, he shaped those expectations. Although he lacked the hero status of von Braun in 1958, he was incredibly influential.

Recognition of his activities would lead many historians to stray further away from institutional histories and governmental documents. If they wish to understand the cultural dimensions of the era, then this move is crucial. Much more could be done to relate Ley's influence to a wider network of popularizers. Asif A. Siddiqi has done this task quite well for the Soviet context.[1738] Americanists could do more to chart the informal networks of exchange, exhibitions, and the public indulgence of scientific fantasies of the future. They could do more to recognize how missile designers "formed a very effective alliance with popular science writers on the 'outside,' who shared with them a sincere belief in the inevitability and benefits of space technology."[1739] In many ways, historians could put those outsiders at the center of the narrative, particularly when asking questions about the relationship between culture and technology. A focus on science writers and other "outsiders" will teach us much about the public sources of information (and misinformation). Combined with rich institutional histories, as well as biographies of engineers and astronauts, this focus on the "outsiders" would help to create a dual portrait of "the architects of two interconnected campaigns, one to foster a

[1738] In particular, see *The Red Rockets' Glare: Spaceflight and the Soviet Imagination* (Cambridge: Cambridge University Press, 2010).
[1739] Ibid., 14.

public enthusiasm for all things cosmic, and the other to convince the government to invest… "[1740] Using the science writers as our key historical actors, we can better understand their influence. These efforts would also explore the many ways in which the history of spaceflight is a history of media as much as a history of technology. Such a focus would begin to provide cultural histories of what is often seen as the greatest moment of cultural shock.

[1740] Ibid., 364.

Chapter 9: The Scholarly Twilight

Willy Ley's last nine years can be labeled as a scholarly twilight of a popular science writer. In some ways, this period could be characterized as an era of fading celebrity-status and misplaced priorities. For example, science fiction historian Sam Moskowitz, in his short three-part biography in *Fantasy Review*, titled his last part as "Losing the Last One."[1741] Moskowitz argued that, as NASA expanded and von Braun became more prominent, Ley "could no longer maintain a dominant position as a popularizer of space knowledge."[1742] Moskowitz also argued, "He was running faster and faster to stay in the same place."[1743] Moskowitz points to a myriad of small jobs, such as translating "American frozen food news into German."[1744] Accordingly, Ley's activities are indicative of a "financial trap," in which Ley struggled to stay afloat from a combination of product endorsements, royalty checks, lecture fees, and various odd jobs. To make matters worse, according to Moskowitz, Ley's efforts were largely wasted on "semi-scholarly" books that failed to attract large audiences.[1745] This account of Ley's last years is not without merit. Archival sources testify to Ley's heightened sensitivity to income and expenses, particularly in 1966. For the most part, Ley worked on overdrive. His most stable income came from book advances with four different publishers. He also struggled to keep his best-selling *Rockets* up to date. By 1968, this

[1741] Sam Moskowitz, "Willy Ley in the U.S.A, Part III: Losing the Last One, " *Fantasy Review* 102 (June 1987): 17-20.
[1742] Ibid., 18.
[1743] Ibid.
[1744] Ibid., 19.
[1745] Ibid., 20.

task was fairly impossible. Additionally, his "semi-scholarly" works were not bestsellers.

In general, Ley stopped contributing to newspapers and magazines, apart from his ongoing series for *Galaxy* and a few publications. Instead, he wrote several short (often juvenile) books on rockets and space travel, while he focused his efforts on semi-scholarly histories of science. By 1960, the space age was well under way. America now had a president who prioritized spaceflight. It also had an organization that would soon put an American into space. A cast of scientists, engineers, and heroes stood in the limelight.[1746] Ley could devote himself to his first true passions. Regarding his continued writing on rockets and spaceflight, one might get the impression that Ley was simply going through the motions to write short books that provided an income, while his real passions lay elsewhere.

Yet, this chapter argues that Ley's last years were not wasted. Although one may get the impression that he was working harder and harder on many competing side projects, Ley displayed an enormous focus on two large histories of science. Firstly, his *Watchers of the Skies: An Informal History of Astronomy from Babylon to the Space Age* (1963) was a massive "opus" to the history of astronomy. Secondly, his *Dawn of Zoology* (1968) presented his most comprehensive account of the "pre-history" of modern science.[1747] By analyzing these works, this chapter devotes less attention to the supposed lost opportunities and more attention to Ley's contributions to the history of

[1746] See, for example, volumes I and II of Shirley Thomas' *Men of Space: Profiles of the Leaders of Space Research, Development and Exploration* (Philadelphia: Chilton Co., 1960-1961).
[1747] See also, Willy Ley, *The Borders of Mathematics* (New York: Pyramid, 1967); Ley's activities also included editing and translating *Otto Hahn: A Scientific Autobiography* (New York: Charles Scribner's Sons, 1966). Additionally, he contributed to an English translation of Kant's *Cosmogony* (New York: Greenwood Pub. Corp., 1968). Other work included a foreword to Deborah Crawford, *The King's Astronomer, William Herschel* (New York: J. Messner, 1968).

science in the 1960s. By analyzing these two books in detail, we can understand how his vision of science and its past related to other developments in the history of science, as it transitioned further into an academic profession. As Ley's perspective broadened, his texts continued to entertain. If there is anything inherently sad about this last decade of his life, it is the fact that younger historians of science were paying less and less attention to his works. His earlier ventures into the history of science were called "scholarly," yet his new ventures (which were overtly more scholarly) were seen as popular and therefore irrelevant to the academic scene. The reception of Ley's semi-scholarly works reveals much about the changing context, particularly in the 1960s.

Whereas Ley's earlier histories of science could be related to anti-fascism during the Second World War, as well as his Cold War liberalism in the 1950s, his histories of science during the 1960s became increasingly "out of step" with the intellectual milieu. In some ways, there is an interesting parallel between Ley's histories and NASA public relations. Just as Ley's perspective was increasingly seen as Whiggish by academic historians, NASA's promotional material (and even the lunar landing itself) seemed increasing anachronistic, presenting a glorified image of American superiority during a deeply ambiguous moment of self-doubt, internal strife, continued civil rights activism, and counter-cultural rebellion.

It is also noteworthy how Ley's glorification of the scientist as explorer/adventurer increasingly contrasted to the image of the institutionalized and lab-coated specialist in an era of "big science" and technocracy. This chapter invites readers to contrast his 1960s works with the other images and representations. Undoubtedly, Ley's glorifications of exploration and Humboldtian scientists continued to influence

popular perceptions. They also encouraged Americans to view astronauts and polar explorers as the heirs of a long tradition of frontier conquest that was bold and exciting. Nevertheless, this chapter argues that these representations, as well as Ley's historical style, grew increasingly out of fashion as many Americans of diverse backgrounds began to ask serious questions about "big science," the exploitation of nature, and the self-serving histories written by scientific enthusiasts. Ley's perspectives became increasingly anachronistic to the broader context, in spite of the culmination of the Space Age in 1969. Consequently, his scholarly twilight helps to reveal many of the competing representations that contributed to 1960s ambiguity. Arguably, his unique blend of romantic modernism would not sit well with a new generation of romantics who became far more critical of modernist fantasies of conquest.

Continuities and Conquests

In perspective of Moskowitz, Ley struggled keep up with the latest developments in space exploration. Events simply moved too fast for an individual science writer to keep the public up-to-date. A myriad of insiders and journalists assumed the role. Overall, Ley became less of a public figure, according to Moskowitz. He was "losing the last one," while drifting into obscurity. In the public's perception, NASA officials and astronauts took center stage.

Although it is true that Ley continued to branch out in semi-scholarly histories of science, this perspective is misleading. Regarding Ley's inability to keep abreast of ongoing developments in the field of rocketry, a researcher simply has to look at Ley's personal files to realize that he documented news, announcements, and technical details

as best as he could. Because he considered himself to be the most prominent historian of the Space Age, he did not neglect his duties when the details became more complex. He collected primary sources obsessively, not only with the goal of utilizing the material for his own articles for *Galaxy*, but also for documenting historical events. He continued to be viewed as an indispensable expert in the field, as he educated millions of Americans about scientific possibilities of various projects, especially Mercury, Gemini, and Apollo.

Ley did not fade into obscurity. He made several radio and television appearances throughout the 1960s.[1748] Although he wrote fewer articles for newspapers, he continued to speak to journalists. He also wrote several book reviews for major newspapers.[1749] He continued to lecture about rockets and space travel. In fact, his "Conquest of Space" lecture became so influential that H. W. Wilson Company included a textual version in its *Representative American Speeches: 1960-1961*.[1750] Ley gave this version of his talk in the summer of 1960 at the University of Colorado where he "spoke to an overflow audience of students, faculty, and townspeople in the large

[1748] In 1960, Ley appeared on the "Sun and Substance" television program. Other television appearances include "At Your Beck and Call," August 11, 1961 and "Camera Three," January 10, 1965. On radio, see "Living Family," rebroadcast August 28, 1960 (WNBC); "Casper Citron Show," September 15, 1960 (WNTA); "Barry Gray Show," December 26, 1960 (WMCA); "The New Explorer—Man or Machine," January 29, 1961 (WBAL-FM); "The Mitch Miller Show," May 6, 1961 (CBS); "Lee Graham Interviews," August 13, 1961 (WNYC); Ley could be heard on many CBS and NBC programs, including "P. M.—Family Living," January 21, 1962; "The Russian Space Feat," August 19, 1962; "Barry Farber," May 16, 1963; "Ask About Space," July 23, 1963; "Ed Joyce," November 11, 1963; "Lee Graham," December 15, 1963; "Barry Farber," March 26, 1964; "Barry Farber," April 29, 1965; "Tex McCrary Time," June 2, 1965; "Ed Joyce," July 15, 1965; "WRFM: Casper Citron," July 19, 1965; "Ed Joyce," August 30, 1965; "WNYC: Teen-Age Book Talk," September 11, 1965. .

[1749] See Willy Ley, "Among the Stars," (Review of Arthur C. Clarke's *The Promise of Space*), *NYT*, August 25, 1968, BR10. See also, Ley, "Voyage to Atlantis," *NYT*, April 20, 1969, BR35; "What Goes On Below?" *NYT*, June 29, 1969;

[1750] *Representative American Speeches: 1960-1961*, ed. By Lester Thomssen (New York: H. W. Wilson Company, 1961):115-130. First published in *The Colorado Quarterly*, Winter 1961.

University auditorium."[1751] Other venues ranged from "Space Fiesta '64" (with von Braun) at Texas A&M University to "Ladies' Night" at the Lockheed Electronics Management Association.[1752] Ley also gave a commencement address at the West Virginia Institute of Technology. Additionally, in 1966, Ley began teaching a Monday night course at The New School in New York City. It was titled "The Universe Around Us."[1753] He taught this course in between lectures in Tulsa, Milwaukee, Lexington, and Kansas City.[1754]

Throughout the 1960s, his space-related writings circulated, albeit in niche publications. Many of these articles displayed a continuity of themes regarding "gaps" and international cooperation. For example, Ley contributed several articles to the newly founded and struggling magazine *Space World*.[1755] His most interesting pieces dealt with the military potentials of spaceflight technologies in the context of the Cold War. In "A Fortress in Space," Ley argued, "it is obvious that there has to be military preparedness in space for safety's sake."[1756] After ruminating on the space station's

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[1751] Ibid., 115.

[1752] According to the flyer, Ley presented "The Conquest of Space" on February 13, 1964, while von Braun delivered a lecture called "Our National Space Program—The Why and How" on February 14, 1964. See also "Ladies' Night Features Willy Ley, Fine Food, Door Prizes," *The Lectern*, July 1967, 1. The tenth anniversary of the Davenport Knive and Fork Club sponsored Ley's talk, "The Conquest of Space." Ley also spoke at Valley State College, Los Angeles State College, Michigan State University. Youngston University, West Virginia University. Additionally, he participated in the "National Tele-Lecture Conference" of 1962. Along with John Cameron Swayze and Vincent Price, Ley was a guest speaker at the Liking County Celebrity Speakers Club during the 1966 and 1967 season.

[1753] See "Display Ad 97," *NYT*, January 26, 1966; "Display Ad 85," January 29, 1966, 28.

[1754] In 1966, his lecture schedule was much less strenuous. Ley may have stopped using an agency for his tours during this year.

[1755] For Ley's articles in *Space World*, see Willy Ley, "All About Orbits," May, 1960, 12, 48-49; "Orbit Around the Sun," July, 1960, 12-13, 50-51; "Getting Around – when we get there," November, 1960, 26-27, 57-61; "Living in Orbit," January, 1961, 21-22, 55-58; "Space Prospectors" March, 1961, 32-33, 52-55; "Project Rover," March, 1961, 20-23, 54; "G-Forces," August, 1961, 44-45, "All About Meteors," September, 1961, 25-27, 52-53. Incidentally, *Space World* tried to a few different tactics to gain a stable readership. A "Willy Ley Space Letter" was offered in the August 1961 issue. See also, Willy Ley, "The Next Twenty-Five Years in Space," *Science Digest*, January 1962, 61-66.

[1756] See Willy Ley, "Spaceways: A Fortress in Space," *Space World*, February 1962, 11.

offensive and defensive tactics, Ley stressed, "We cannot neglect space defense."[1757] A newsletter also warned of the consequences of Soviet superiority: "Near-future space feats of the Soviets may include hurling a 50-megaton H-bomb to explode on the moon; setting off a 100-megaton device 5000 miles high, visible to half the world…" Ley concluded, "All would be 'ballistic blackmail' to… panic America at Russia's 'overwhelming space-power'—and that statement might then be true, jittery experts warn."[1758] Ley also warned of a future "Victory gap" in the coming space war, because "Washington is keeping military men out of space policy decisions… [while] Moscow is loading its top leadership… with uniformed experts."[1759] In spite of his earlier perceptions of totalitarian control of science, he pleaded for total mobilization. Like other scientific intellectuals, Ley displayed little awareness of the intense contradictions. There were no instances of self-reflection on the incorrect assumptions about totalitarianism and science. Americans simply had to adapt to changing political and technological realities.

He also thought in terms of an imminent "space war." In 1966, for example, *Popular Science* ran his article, "Cold War in Space."[1760] Ley argued, "There's a strange, secrecy-shrouded contest, short of open hostilities but with deadly serious military implications."[1761] Ley speculated on the capabilities of "surveillance satellites," "Orbiting H-bombs," and "Antisatellite weapons." Ley concluded this article on a hopeful note about a "moon treaty" between the United States and the Soviet Union.

[1757] Ibid., 12.
[1758] Ibid., 14.
[1759] Ibid.
[1760] Willy Ley, "Cold War in Space," *Popular Science*, August 1966, 41-45, 170. See also, "The Next Five Years in Space," *Popular Mechanics*, February 1967, 92-97, 212.
[1761] Ibid., 41.

Such a treaty would be "a hopeful sign that adventures to other worlds may leave the earth's conflicts behind." It is striking how often Ley wavered between an anti-totalitarian anxiety of technological "gaps" and lingering hopes for scientific internationalism.

He also continued to write space-related articles for *Galaxy*. One of his most noteworthy articles was titled: "Are We Going to Build a Space Station?"[1762] Ley reassured readers that the scientific and engineering goals had not been lost amidst the current debate about thrust and the moon.[1763] Other articles included "The End of the Jet Age," "Sounding Rockets and Geoprobes," and "Anyone Else for Space?" [1764] When Ley was not updating readers on recent developments, he continued to explore the pre-history of American and Soviet Rocketry.[1765] Yet, in *Galaxy*, his spaceflight articles became somewhat less frequent.[1766] He obviously enjoyed writing different articles like "A Century of Fossil Men," and "The Rarest Animals."[1767]

[1762] Willy Ley, "Are We Going to Build a Space Station?" *Galaxy*, December 1962, 125-135; "The Area of Accessible Space," August 1964, 70.
[1763] This article also briefly discusses the behind-the-scenes conferences of *Collier's* space-themed issues.
[1764] See, for example, Willy Ley "The Air on the Moon," *Galaxy*, August 1960, 67-78; "Earth's Extra Satellites," February 1962, 55-64; "Names in the Sky," April 1962, 38-51; "The End of the Jet Age," October 1962, 73-81; "Sounding Rockets and Geoprobes," April 1963, 88-101; "Anyone Else for Space?" June 1964, 110-128; "The Observatory on the Moon," June 1965, 132-142; "Astronautics International" December 1967, 110-120; "Interplanetary Communications," June 1968, 116-123; "Mission to a Comet," September 1968, 101-109; "The Orbit of Explorer-1," October 1968, 93-102.
[1765] See Willy Ley, "First Flight By Rocket Power," *Galaxy*, February 1963, 77-91; "Max Valier and the Rocket-Propelled Airplane," May 1969, 97-106; "Eugen Sanger and the Rocket-Propelled Airplane," July 1969, 98-107.
[1766] In 1961, there is not a single space-focused article by Ley in *Galaxy*. Instead, he wrote articles like "The Puzzle Called Gegenschein," "Let's Do Something about the Weather," and "Dragons and Hot-Air Balloons."
[1767] Willy Ley, "A Century of Fossil Men," *Galaxy*, August 1964, 81-90; "The Rarest Animals," December 1964, 94-103. Throughout the early 1960s, Ley was also becoming increasingly interested in reports of "Rotating Luminous Wheels in the Sea," which he attributed to luminous organisms that mysteriously "turned on" and spiraled. Ley began to collect eyewitness reports, while he simultaneously debunked UFOs and legends of Atlantis. See Willy Ley, "Rotating Luminous Wheels in the Sea," *Galaxy*, August 1962, 101-114. See also, "Another Look at Atlantis," *Galaxy*, June 1967, 74-84.

Throughout this decade, Ley wrote many short spaceflight books for juvenile and adult audiences.[1768] For example, after completing the bulk of work for his massive first "opus," Ley edited a collection of governmental reports into a far more readable book, *Harnessing Space* (1963).[1769] Each chapter focused on the peaceful uses of artificial satellites to instigate scientific revolutions in meteorology, astronomy, and communications. Ley stated his central argument: "For mysterious reasons—if there are any reasons at all—a large section of the public has clung stubbornly to the belief that space research is for military purposes only…" Ley argued, "The simple fact is, of course, that space has military uses…. But the proportion of peaceful activities to the purely military uses of space is about the same as that of the number of warships to commercial vessels on the Atlantic Ocean."[1770] The book made the case for the economic and scientific advantages of peaceful space exploration.

A more substantial contribution to spaceflight popularization can be seen in Ley's ongoing collaboration with Bonestell, which produced *Beyond the Solar System*

[1768] Ley also wrote forewords for Bertrand R. Brinley, *Rocket Manual for Amateurs* (New York: Ballantine Books, 1960); Dandridge M. Cole and Donald W. Cox, *Islands in Space: The Challenge of the Planetoids* (Philadelphia: Chilton Books, 1964); John Rublowsky, *Light: Our Bridge to the Stars* (New York: Basic Books, 1964); Lawrence Maisak, *Survival on the Moon* (New York: Macmillan, 1965). See also Willy Ley, "Introduction," in Jules Verne, *Dr. Ox's Experiment* (New York: Macmillan, 1963), *Around the World in Eighty Days* (New York: Scholastic Library, 1964), and *From the Earth to the Moon* (Greenwhich, Conn.: Fawcett Publications, 1968); Ley, "Introduction," in Thomas Moffett, *The Theater of Insects* (New York: De Capo Press, 1967).

[1769] *Harnessing Space*, ed. Willy Ley (New York and London: The Macmillan Company and Collier-Macmillan Limited, 1963). See also, Ley, *Inside the Orbit of the Earth* (New York: McGraw-Hill, 1968). For juvenile and general scientific works, see Ley, *The Meteorite Craters* (New York: Weybright and Talley, 1968); *The Discovery of the Elements* (New York: Delacorte Press, 1968); *Forbidden Tunnel* (Chicago: Science Research Associates, 1968); *Events in Space* (New York: D. McKay Co., 1969); *Visitors from Afar: The Comets* (New York: McGraw-Hill, 1969); *The Drifting Continents* (New York: Weybright and Talley, 1969); *Gas Planets: The Largest Planets* (New York: McGraw-Hill, 1969); Ley also published several short pamphlets for the science service. See Willy Ley, *Ballistics* (Garden City, N.Y.: Doubleday, 1961); *Planets* (Garden City, N.Y.: Doubleday, 1961); *Fire* (Garden City, N.Y.: Doubleday, 1963). Additionally, Ley served as chief consultant for the Encyclopaedia Britannica's educational film *Space Probes: Exploring Our Solar System* (1964).

[1770] Ibid., 16.

(1964).[1771] Once again, Bonestell received top-billing for his beautiful paintings. Wernher von Braun also wrote the book's forward. As with other collaborations, Ley supplied the text. *Beyond the Solar System* is by far the most speculative of Ley's collaborations with Bonestell, despite contrary claims by von Braun. The first chapter narrated a manned trip to Alpha Centauri. Ley admitted that this trip is not feasible in the immediate future. He presented readers with calculations for a rocket that traveled 10 miles per second. Even at this speed, it would take 68,500 years to get to the nearest solar system. Ley argued, "Since anything we could possibly do within a decade after the moon landing would be hopelessly inadequate, let us at least see what would be needed, even if we don't know how to build it."[1772]

For the remainder of the text, Ley struggled to find a happy middle ground between scientific reasoning and pure fantasy. His tone reads as hesitant and reluctant. He reminded readers: "The thing to keep in mind is that all the many questions concerning an interstellar trip will be answered by people whose knowledge in each particular field will be many times greater than ours."[1773] The book also presented a "hypothetical inhabited" planet at a distance of 3240 million miles, as imagined by Bonestell. In other images, Bonestell painted alien landscapes, which were almost purely works of science fiction. Arguably, *Beyond the Solar System* was the least successful collaboration with Bonestell. Unlike *Conquest* and *Exploration*, it was not formatted in coffee-table size. For the most part, the paintings by Bonestell are somewhat lifeless and dull, compared to earlier works.

[1771] Willy Ley, *Beyond the Solar System* (New York: Viking Press, 1964).
[1772] Ibid., 23.
[1773] Ibid., 27.

Ley wrote several other short books, such as *Our Work in Space* (1964) and *Events in Space* (1969).[1774] Additionally, Ley produced several books for New American Library. These small pulps included *Missiles, Moonprobes, and Megaparsecs* (1964), *Ranger to the Moon* (1965), and *Mariner IV to Mars* (1966)[1775] After New American Library published these mass marketed paperbacks, Doubleday began to reprint Ley's *Galaxy* articles in *Willy Ley's For Your Information: On Earth and Sky* (1967).[1776]

By far, his most influential contribution to the scene can be read in his last revision and expansion of *Rockets*, which was re-titled as *Rockets, Missiles, and Men in Space* (1968). [1777] The book contained almost 50% new material, which updated readers on contemporary developments in spaceflight technologies. The most notable addition to the book was a history of "space men." In fact, Ley rededicated the book. Instead of continuing to dedicate it to Olga, he wrote: "The new version of my book is dedicated to the space explorers of the next generation who will want to know what their fathers thought and did."

In the book's foreword, Ley reflected on the evolution of *Rockets*, as it had grown from 288 to 576 pages. Whereas his 1944 edition was fairly evenly split between historical accounts and future predictions, his 1968 edition was entirely historical, with few immediate predictions. Ley wrote, "What you are holding now is virtually all

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[1774] Willy Ley, *Our Work in Space* (New York: Macmillan, 1964); *Events in Space* (New York: D. McKay Company, 1969).
[1775] Willy Ley, *Missiles, Moonprobes, and Megaparsecs* (New York: New American Library, 1964); *Ranger to the Moon* (New American Library, 1965); *Mariner IV to Mars* (New York: New American Library, 1966);
[1776] Willy Ley, *Willy Ley's For Your Information: On Earth and Sky* (Garden City, NY: Doubleday, 1967); For a similar collection of Ley's essays, see *Another Look at Atlantis and Fifteen Other Essays* (Garden City, NY: Doubleday, 1969)
[1777] Willy Ley, *Rockets, Missiles, and Men in Space* (New York: Viking Press, 1968).

history; the amount of prediction that remains is negligible…"[1778] Ley added, "Some people may feel that this is a sad state of affairs—it was so nice to dream. But there is no reason for regret. When all the current projects have been carried out they will form a firm basis on which to build still another set of dreams."[1779]

Apart from significant revisions to specific chapters, Ley added a large chapter on "Man in Space." As one might expect, the first American astronauts are described as incredibly brave explorers, who endured stress tests and other physical discomforts. Ley's description of future astronauts was somewhat similar to his earlier predictions in *Space Pilots* (1957). Ley wrote: "He had to be in perfect physical condition… He had to have experience with machinery; and preferably should also have had experience in extricating himself from difficult situations, a requirement that spelled 'test pilot.'"[1780]

Ley then described John Glenn's 1962 orbital flight in dramatic and heroic terms. Ley delighted in combining a description of the astronaut as a bold adventurer who longed for a breathtaking view of the heavens with a more down-to-earth representation of an engineer. For example, Glenn "really wanted… a capsule that was all glass," so that he could marvel at the wonders of nature.[1781] Yet, after re-entry and splashdown, his words "were not the kind later put into the mouth of a hero in a play." Glenn simply remarked, "It was hot in there." Other Mercury astronauts used similar language. For example, Walter Schirra was not very impressed by the view. He remarked, "…it was the same old deal; I might as well have been in a jet 40,000 or

[1778] Ibid., vii.
[1779] Ibid.
[1780] Ibid., 374.
[1781] Ibid., 383-384.

50,000 feet up."[1782] Schirra also compared himself to a chimpanzee, since nearly every decision and action was made on the ground. Nearly all of the American astronauts have personalities in Ley's account. Russian cosmonauts are simply names, without personalities.

By far the most emotional description of this new breed of explorers occurs in "Postscript: 'If we die…'" Ley begins by quoting Grissom, who told the press: "If we die, we want people to accept it. We are in a risky business… The conquest of space is worth the risk."[1783] Ley stated, "The tragic fact is that Grissom did die, along with Edward H. White II, who had been the first American to leave a spacecraft in flight, and Roger B. Chaffee, who was still looking forward to his first trip above the atmosphere." Ley then described the fatal circumstances of their death during a simulation, when a spark of electricity ignited the pure oxygen atmosphere of the cabin. Implicit in this narrative is a deep respect for the daring explorers who risked their lives for the conquest of space.

Ley ends his new version of *Rockets* with a celebration of human exploration:

> Of course there is no proper ending to the story of rockets and spacecraft to come, any more than there was a proper ending to a story of exploration of our own earth when the North Pole had not yet been reached, Antarctica was merely known to exist, and the interior of Asia was forbidden territory. By now, of course, the exploration of our own planet may be said to have been completed… The exploration of space will go on forever and ever….[1784]

[1782] Ibid., 386.
[1783] Ibid., 400. According to daughter Sandra Ley, the only time she saw her father cry was during television reports of the disaster.
[1784] Ibid., 418.

The astronauts would be the new heirs of a long tradition of scientific exploration. Their voyages of discovery were beginning. Their frontier was endless.

Although historians of technology ignored the book, the reception of Ley's final revision of his best seller was mostly positive. One reviewer labeled the book as "his history-cum-encyclopedia."[1785] Although many reviewers were intimidated by the size of the book and the inclusion of technical information, they generally agreed that Ley's new edition was clear and definitive. One reviewer noted: "Willy Ley has done his usual superlative job in putting it all together in a clear, concise and eminently readable fashion."[1786] He added, "If you can buy only one book to learn not only the past but the future of space flight, this is the one to buy – accept no substitutes."[1787] NASA's first historian, Eugene M. Emme, doubted that Ley's new edition was "definitive," given the progress of events. Yet, he noted, "Having gone through 21 printings and 4 complete revisions since it first appeared… Ley's now standard history has a history of its own."[1788] According to a review in *Library Journal*, Ley's new edition was "truly monumental… the complete record of rocketry and its place in today's world."[1789] A reviewer for the *Houston Post* argued, "Every field has a best reference book for laymen, and this is the one for those interested in the history of space flight."[1790]

[1785] See "Books.. Space Flights," *Los Angeles Herald-Examiner*, June 9, 1968, G6.
[1786] George W. Earley, "Beyond the Earth," *The Hartford Courant*, June 16, 1968, BBR.
[1787] Ibid.
[1788] Eugene M. Emme, "Space, Past, Future," *Science* 161 (August 30, 1968): 874. With a retrospective glance, Emme added: "The 1951 edition… infected scores of American readers with eagerness for the coming space venture."
[1789] "Display Ad 378," *NYT*, May 12, 1968, BR24.
[1790] "Display Ad 330," *NYT*, July 28, 1968, 262.

Richard Lewis of *Book World* also wrote, "Ley is unexcelled in explaining the technology of rockets and the orbital mechanics of space flight."[1791]

Thus, rather than "losing the last one," Ley continued to occupy a privileged role as a prominent expert and popularizer. Nevertheless, Moskowitz was correct to highlight shifting priorities. Ley had a broader agenda.

Science as the Humanities

In the September 1960 issue of *The Instructor*, Ley titled a short article "It's not science Versus the humanities."[1792] He began his plea by stating: "Though most people know it, it might be well to start off with the statement that I was born and raised in Germany. Coming to the United States at the age of twenty-eight, I found an overwhelming number of things which I like, a few which I dislike (e.g. sweet potatoes), and a few which I don't understand (e.g. baseball)." He continued, "Among the things I do not understand—and I am now dead serious—is making a distinction between 'science' and 'the humanities' with resulting discussions about which one should be emphasized." Ley then stated his conviction: "Such talk has no meaning whatsoever, for if 'the humanities' means the elements of our culture, then certainly science is part of the humanities." In other words, science was a human activity, which could not be divorced from a broader culture. Science reflected human values, beliefs, and aspirations. To talk of "two cultures," as C. P. Snow had done, was simply nonsensical and misleading.

[1791] Ibid.
[1792] Willy Ley, "Points of View: It's not science Versus the humanities," *The Instructor*, September 1960, 5.

Ley then paraphrased an editor who told him that the distinction was valid, since a subject like history "can be 'really taught' while the pupil must take the results of scientific research at face value." In Ley's view, this perspective was absurd. In fact, the opposite was far more accurate: "The teacher has been taught in college that the greatest epic of classical antiquity is the Illiad. (Personally I think the Odyssey is greater, but let's not go into that at this point.) She passes this knowledge on to her twelfth-graders… The students must accept these statements, for the most they can do is to read samples of their work in translation." "Even then," Ley argued, "they still have to take the teacher's word at face value…" Conversely, science was far more open to independent verification by amateurs. Ley wrote, "Compared to what the pupil would encounter in checking the claims of 'the humanities,' there are virtually no problems in checking the statements of elementary science." Every child, Ley claimed, could easy confirm the validity of the Pythagorean theorem or the weights of lead and iron. This verifiability, combined with the social importance of science, put science at the top of the humanities. He concluded, "Today's surroundings are mostly 'science,' and I hold that the purpose of all teaching is to create an understanding of our surroundings." Despite its complexity, science was "not beyond understanding." As Ley argued in a draft manuscript for a book titled *Not Beyond Understanding*, "The things that are not beyond understanding are the laws of Nature that are around us every minute of our lives from birth to death."[1793]

In a different article, Ley outlined the broader agenda of educating ordinary Americans. He asked, "Do we want to make everybody a scientist? Do we want to

[1793] Willy Ley, Draft Manuscript: *Not Beyond Understanding*, WLC, Box 7, Folder 1.

make everybody a humanist?"[1794] He answered, "We couldn't do that. But, what we could, and should, do is to produce in the next generation and in ourselves by application… the equivalent of what you call the music-lover or the art-lover." The educator should guide his students "in the direction of being lovers of science." Only a small percentage of students would actually become scientists. The educator was not there to train future scientists. Instead, the educator should train "an understanding public." Ley added: "What we must produce is a scientific equivalent of that [music appreciation], not a young man or young woman who learns science to practice it later but who learns science (with a little forced start in the beginning) to be able to follow what the scientists are doing and not say, 'I don't understand this'." Ley also argued, "The effort should be directed, I feel, in producing an audience for the scientists of today and the audience for the scientist of the future." In an earlier interview, Ley expressed his optimism regarding the privileged role of a science writer as a trained communicator: "If somebody says this or that cannot be explained to the layman… this person either does not have enough factual knowledge or else insufficient skill as an interpreter."[1795]

Like other science writers, Ley would use case studies in the history of science to advance this agenda. He would debunk the notion of "two cultures." The history of science would serve as more than a simple "interface" between two cultures.[1796] It would demolish the very distinction.

[1794] Willy Ley, "The Space Age and Education," *Journal of the New York State School Boards Association, Inc.*, December 1960, 105.
[1795] Ley, *World Authors*, 1553.
[1796] Literary scholar Elizabeth Leane argues that the post-1970s boom in popular science must be viewed in terms of an interface between two cultures. See Elizabeth Leane, *Reading Popular Physics*.

The Conquest of Earth

In 1962, Ley wrote *The Poles*, a Life Nature Library book that combined breath-taking photographs with dramatic text.[1797] Ley titled his chapters with phrases like "The Cold, Far Frontiers," and "The Great Antarctic Laboratory." Both in style and format, the book resembled Ley's earlier *The Conquest of Space* (1949), albeit focused on earthbound exploration of "the extremes of the earth." Key themes included the mysteries the unknown, the sagas of brave explorers, and the vast scientific and economic opportunities of man's conquest of the North.

The language of the text illustrates how easily Ley's views of earthbound exploration matched his vision of cosmic exploration. In the opening pages, Ley wrote:

> The poles have long been a challenge, remote, and forbidding, to man's sense of venture and curiosity. Today, in the sweep of technological revolution, the Artic has become a highway, and tomorrow both the polar regions may be exploited for food, minerals and other materials needed to support man's steadily expanding population.[1798]

Ley then launched into a discussion of the scientific wonders of both realms, before devoting two chapters to the history of Artic and Antarctic exploration. Ley argued, "Not until over a century ago did the exploration of the far north become a pressing challenge to the questing human spirit. Yet even in antiquity, it seems to have beckoned a few imaginative souls."[1799] His retellings of past adventurers are dramatic, exciting, and often tragic tales of human endurance and the basic, fundamental drive to conquer nature. The chapter on Artic exploration concluded with these words: "Man has indeed become master of the Artic, but he has many earlier men to thank for it." Just as Ley's

[1797] Willy Ley, *The Poles* (New York: Time Incorporated, 1962).
[1798] Ibid., 9.
[1799] Ibid., 31.

histories of space travel celebrated the founding fathers, his histories of polar exploration glorified the pioneering and fearless adventurers.

Ley also examined the "odd polar animals," such as the "perky, peculiar penguins," the "ugly elephant seal," the "wondrous walrus," and the narwhal, which Ley called "the unicorn of the artic."[1800] Ley playfully assembled odd and interesting facts about animals, the landscape, and the hostile environment. The book then focused on the strange and curious people who inhabit certain regions. Ley discussed the "primitive peoples" who are "preservers of Stone Age life."[1801] The text displayed Ley's admiration and respect for the "artic aborigines," while the remainder of the book fantasized about modernization. Ley expressed fascination with a paradoxical reality: "They are more than the hardiest people on earth. Among them also are—some of the happiest of humans. Their survival is a supreme example of human adaptability. Their happiness, springing from a philosophy and way of life that civilized people have long abandoned is a triumph of the human spirit."[1802] Ley cautioned readers by stating that "civilization is not to be confused with culture—the complex of beliefs, customs, institutions, tools and techniques by which a society lives—and the artic peoples developed some of the world's most ingenious and interesting cultures."[1803]

Despite this admiration for indigenous cultures, Ley anticipated few negative consequences to the civilizing process that will accompany modernization. In fact, he even made the case for inevitable racial harmony: "Whites and natives are mixing and changing… Eskimos and Indians have become American military pilots and riflemen…

[1800] Ibid., 83-101.
[1801] Ibid., 129.
[1802] Ibid.
[1803] Ibid., 130.

Lapps in Norway publish their own newspaper, and the Athabaskans at Fort Yukon have formed a jazz band…"[1804] Arguably, this passage illustrated the complexities of modernization, which did not simply bring civilization to the frontier. Rather, civilization (and Western culture) adapted. Ley argued, "By now, the mixing of aborigines and immigrants is almost complete." This "new breed" will have "adapted to the strenuous requirements of the Arctic, and the struggle for existence has toughened their bodies and developed their minds."[1805] Ley added, "They are a hardy, independent people with a remarkable spiritual and material culture, and they are certain to play major roles in the coming arctic boom."[1806]

The remainder of the book celebrated the inevitable "boom." Ley made many predictions about the future. He wrote, "World trade and travel are taking to the skies, and the north is their great short cut. World power has passed to the continent-sized nations rimming the Arctic, and the north is the frontier they must man and maintain."[1807] Ley viewed these trends in the context of the Cold War: "Because so much Soviet land and resources lie so far north, the Russians have taken the lead in opening up their northlands."[1808] Fortunately, Canada and the United States are making up lost ground. Ownership of the north became an issue of vital importance, because "Population, technology, military needs… are thrusting civilization farther north."[1809] Ley was quite optimistic about the untapped resources of the "Great Tomorrow Land." The last chapter focused on the scientific uses of Antarctica. One illustration presented

[1804] Ibid., 136.
[1805] Ibid.
[1806] Ibid.
[1807] Ibid., 151.
[1808] Ibid., 152.
[1809] Ibid., 151-152.

readers with a domed city of the future that protected its inhabitants from the cold and desolate landscape. There is even a light on a tower that serves as an "artificial sun."

Mankind stood poised to transform a barren and hostile environment into a world of tomorrow. The conquest of the earth neared completion. The spirit of mankind would prevail over the challenges of nature.

Watchers of the Skies

Throughout much of the early 1960s, Ley worked on a different book that would be his "opus" to the history of astronomy: *Watchers of the Skies: An Informal History of Astronomy from Babylon to the Space Age* (1963). He dedicated the book to Viking editor Pascal Covici, who had done so much for Ley and other science writers.[1810] In the book's foreword, Ley outlined the ambitions of the book: "Astronomy, all historians are agreed, is the oldest of the sciences, with the automatic result that its history is not only of great length but of extraordinary complexity… To write a history of astronomy that is worth the reader's time therefore anything but easy."[1811] Ley then admitted that the task was fairly impossible because a joint effort of experts to write such a book would result in a "reference text" which could not be readily accessible by lay audiences. There were, of course, books that tried to tell a comprehensive history of astronomy. These "horrible examples of one-volume 'stories of astronomy'… seemed designed to obscure its history," Ley argued. He added: "They tried to look 'historical' by mentioning a few names and dates of the past but were far from historical in that they

[1810] In Wernher von Braun's foreword to *Beyond the Solar System*, he wrote, "Pascal Covici of The Viking Press had been the godfather to every one of these projects since those misty, pre-Sputnik days when talk about orbital flight and planetary probes was still considered an obvious symptom of a twisted mind." See *Beyond the Solar System*, i.
[1811] Ley, *Watchers*, xi.

did not even discuss the thoughts, correct or mistaken, of the people mentioned."[1812] Most egregiously, they often conveyed "the impression that all but a few of the problems had been solved."

Ley then clarified his historical methodology: "The fact that in a history of any subject one should let the people who made that history speak for themselves had its influence on the arrangement of the present work."[1813] Ley not only sought to present historical actors on their own terms, but he also sought to present a unified portrait of astronomy. The history of astronomy "proceeded in a reasonably straight line from the beginnings of science to about the middle of the eighteenth century… [before] two things happened." First, the number of astronomers greatly increased. Secondly (and consequently), the field of astronomy branched into a web of maddening complexity, as various sub-disciplines pursued their own avenues of research. Ley's opus attempted to bring clarity and unity to the field. Astronomy desperately needed that sense of unity.

Ley made few apologies for what the text excluded. Any discussion of cosmogony belonged to a "'history of natural philosophy' rather than that of 'history of astronomy.'"[1814] Any discussion of Chinese constellations belonged "in a book on Chinese culture… [because] their constellations did not influence our own…" "Similarly," he argued, "the star myths which were developed by many 'primitive' peoples have been disregarded."[1815] His massive and unified history of astronomy would be inseparable from the history of Western thought and culture. This fact was a given.

[1812] Ibid.
[1813] Ibid.
[1814] Ibid., xii
[1815] Ibid.

In part one, "A Science Grows Up," Ley presented an entertaining and educational history of stargazing from ancient times to "The Celestial Century" that followed Sir Isaac Newton's *Principia*. After ruminating on the possible observations of prehistoric humans, Ley discussed the "proto-astronomy" of early religions. For "proto-astronomy" to transition into a science, three conditions had to be met. The sky had to be clear with some degree of regularity. A certain number of people needed leisure time to make observations. Most importantly, they needed the means of recording those observations "for the purpose of passing information on to future generations."[1816] All three conditions came together in ancient Mesopotamia, with Persian and Babylonian "priest-astronomers."[1817] Here, Ley gives the impression that ancient astronomers did not possess a true sense of wonder about the cosmos. Instead, they appreciated the utility of observations for time-keeping and ceremonial predictions. He also attributed a "future pattern of astrological beliefs" to the Babylonians who concluded that "Jupiter brings good luck; Mars and Mercury can bring bad luck." After a brief discussion of calendar systems, the zodiac, and other utilitarian uses of "proto-astronomy," Ley focused on the Chaldeans who conducted "observation, not distracted by a search for omens…"[1818] Despite their clear-minded approach, the Chaldeans were unfortunately still stunted by their religious worldview. Ley added, "Their calculations were a form of worship and they did not need to develop an astronomical system because their religion told them what the world was like." Consequently, their astronomy "petered out." Ley then devoted many pages to debunking the mathematical "manipulations" of nineteenth-century "pyramidologists" who made nonsensical claims about ancient Egyptian

[1816] Ibid., 4.
[1817] Ibid., 6.
[1818] Ibid., 10.

astronomical knowledge.[1819] After this "excursion into silliness," Ley turned to ancient Jewish scholars, who "rejected the study of the sky as both 'foreign' and 'godless'."[1820] Due to their religious beliefs, astronomy "could not develop among the Jews."[1821] Science had to overcome superstition and mysticism.

The ancient astronomers, for the most part, were blinded by cultural and religious beliefs. The Greeks served as the main exception. Their philosophical debates took them in the right direction. The most entertaining part of Ley's discussion of Greek philosophers centered on Plato's upstart disciple Aristotle, who tried "like Alexander von Humboldt… to know everything."[1822] Rather than defer to a sacred text or legend, Aristotle's goal "was, of course, to produce a complete picture of the universe—one which explained everything, and left nothing out…"[1823] In a feat of independence and bravery, Aristotle broke with Plato's universe of ideas. For Aristotle, "the world of visible phenomena was the real world."[1824] Accordingly, Aristotle was the first real scientist, urging "careful observation and description—and even some experimentation." Unfortunately, his greatest virtue was also his greatest flaw. "Aristotle's fundamental mistake," Ley wrote, "was to underestimate the magnitude of the task [of knowing] and to conclude that he personally knew enough to draw conclusions." Aristotle's over-confidence would have lasting consequences.

Ley then discussed the contribution of Aristarchos, Plutarch, Archimedes, Erastosthenes and other Greek philosophers. Much of the text reads as chronological

[1819] Ibid., 19.
[1820] Ibid., 21.
[1821] Ibid.
[1822] Ibid., 30.
[1823] Ibid., 30.
[1824] Ibid., 31. Remaining quotes in this paragraph are located on this page.

listings of the various contributions of key philosophers. The discussion of Greek astronomy also contained a long evaluation of Ptolemy and his legacy. In Ley's perspective, Ptolemy deserved praise for only two things: he labored diligently, and he preserved the work of Hipparchos. Otherwise "he showed himself to be as reactionary as possible."[1825] Ptolemy deferred to the authority of Aristotle, while he remained blind to the truths around him. "Why didn't he open his eyes?" Ley asked.[1826] Instead of evaluating the evidence and experimenting, Ptolemy "strained all resources of rhetoric and argumentation…"[1827] Ley added, "It is quite possible that he was a pure theorist."[1828]

What followed can be summarized as a long period, in which the science of astronomy slowly lingered in darkness. While Ley praised the Arabic efforts to preserve the Greek texts, he saw very little cultural exchange. The history of astronomy suffered through an "interregnum." Ley explained: "Of course things were going on, but no real progress was made. It is true that the lifetime of Ptolemy falls into this period… One might even argue that Ptolemy's dogmatic adherence to the view of that earlier era contributed heavily to the sterility of the interregnum."[1829] Instead of flourishing cultural exchange and the spread of new ideas, the medieval period is portrayed as one of deep stagnation and deference to established authorities. Ley argued, "the words 'The Philosopher' meant Plato; subsequently they meant Aristotle."[1830] He added: "The later Middle Ages indulged in a kind of Aristotle cult; if a fact could not be found in his

[1825] Ibid., 42.
[1826] Ibid., 43.
[1827] Ibid., 42.
[1828] Ibid.
[1829] Ibid., 48.
[1830] Ibid., 31. Subsequent quotes in this paragraph are found on this page.

works, that fact obviously did not exist." Overall, the medieval scene was a "long and naturally sterile period…"

The reign of authoritarian dogma ended during the Renaissance, when brave and bold adventurers challenged established thought. Their ties to broader movements were obvious to Ley. He wrote: "On October 31, 1517, one Martin Luther had nailed ninety-five theses on the heavy oaken doors of the church of Wittenberg, Germany. And on February 19, 1473, Nicolaus Copernicus had been born…"[1831] Ley thus implied a direct connection between the Reformation and "the" Scientific Revolution. Simultaneously, Ley lamented the fact that Copernicus was still a product of his time. Regarding the *Commentariolus*, "Those opening pages… sound so 'modern' that a reader of today who proceeds further suddenly feels something quite close to disappointment. This 'modern' concept is darkened by the persisting epicycles."[1832] Ley continued: "Copernicus has epicycles running on epicycles."[1833] This nonsense was dizzying.

Despite these flaws, his revolutionary spirit and system would eventually inspire other bold and daring thinkers to nail their theses to the proverbial doors of science. Much impetus from this iconoclastic spirit came indirectly from Copernicus and more directly from the invention of the telescope and the "inevitable collapse of whatever remained of Aristotle's philosophy."[1834] In some ways, the telescope was unnecessary due to "Tycho's Star," a supernova "which everybody had seen."[1835] The "exchangeability of the firmament" had collapsed overnight, and this undermined the

[1831] Ibid., 61.
[1832] Ibid., 70.
[1833] Ibid.
[1834] Ibid., 82.
[1835] Ibid.

entire core of Aristotle's worldview. Resistance to new ideas continued, particularly with Tycho Brahe's attempt to "save the phenomena."[1836] Nevertheless, the tide of change could not be stopped. Like Aristotle's break with Plato, Johannes Kepler broke with Tycho Brahe. While the systems of both Copernicus and Brahe had been "darkened" by persisting nonsense, Kepler saw the light. As such, "he became the intellectual successor and 'completer' of Nicolaus Copernicus."[1837]

Medieval superstitions still haunted Kepler, particularly when the public demanded astrological explanations for the "new star" of 1604. It is interesting how Ley presented Kepler as a public educator who walked a tight rope between science and sensationalism. Ley wrote:

> Kepler observed the star as it gradually faded and delivered "citizens'" lectures about it. He stressed the fact that it was a fixed star and also that Aristotle had been wrong in saying that there were no changes in the starry sky. This new star obviously had originated by the condensation of celestial matter. That it had been ignited by the conjunction of the planets was nonsense, but it was also nonsense to think that the time and place of the appearance of the new star was just a coincidence. It appeared then and there by the will of God, presumably to indicate His will.[1838]

All too reluctantly, Kepler "simply repeated what others had said: that the world would burn up, that all Europeans would move to America, that the Realm of the Turk would be destroyed… and so forth…"[1839] Regarding astrology, "Kepler—who after all was a child of his time—generally believed in the idea of astrology, disbelieved its rules, but cast horoscopes according to these rules because he was paid for them."[1840] In spite of this tendency to dabble in mystical or pseudoscientific enterprises, Kepler ventured forth, fearlessly concluding that perfect, circular motion had been the reigning

[1836] Ibid., 90.
[1837] Ibid., 93.
[1838] Ibid., 99.
[1839] Ibid.
[1840] Ibid.

myth of all learned astronomy prior to his day. In *Astronomia nova*, Kepler debunked the myths and countered the skepticism and resistance of even his close friends.

It was not long before the spread of the telescope lent credence to Kepler's first "law." Galileo Galilei carried the torch further, while serving as "the third of the great and fiery triangle of astronomical innovators of the period…"[1841] As if viewing the world with new eyes, Galileo discovered things that were "easy to test experimentally, and Galileo (this is where he differed from most of his contemporaries) did test…"[1842] Ley then explored the history and myths surrounding Galileo's famous experiment atop the Tower of Pisa. According to Ley, it was a routine experiment done countless times by Galileo's predecessors who misrepresented Aristotle's teachings. "The ones at fault," he concluded, "are the later 'popularizers' who transformed a routine demonstration into a one-time dramatic performance…"[1843] Galileo "was just conducting an experiment which he probably knew had been performed before."[1844] His real contribution to the astronomical scene surrounded his detailed observations of the distant stars and the moons of Jupiter, as reported in the *Starry Messenger*. The implications of Galileo's observations were obvious, even to Kepler, who doubted some of the conclusions. Yet, Kepler "went further" arguing, "Produce ships and sail which can be used in the air of the sky. Then you'll also find men to man them, men not afraid of the vast emptiness of space."[1845]

The remainder of the chapter recounted Galileo's many public battles against detractors and intransigent philosophers. Implicit in Ley's portrayal of Galileo is an

[1841] Ibid., 105.
[1842] Ibid., 106.
[1843] Ibid., 109.
[1844] Ibid., 109.
[1845] Ibid., 113.

admiration of a fearless and antiauthoritarian debunker, who often took his case directly to an educated audience. Galileo soon faced powerful opponents who stood "united only in the beliefs that there was no need for new facts, that the facts were already established, and that they could be found in Scripture."[1846] As a man of science, Galileo braved "an all-out attack" from the authoritarians and their pseudoscience.[1847] The "main blow" came from literal interpreters of biblical truths.[1848] Ley regarded the Catholic Church as an annoyed bystander to these attacks. After a "foolish sermon" and public controversy, the Church was forced to intervene. Nevertheless, powerful traditionalists stood in the shadows, waiting for an opportune moment to strike the scientist down in "the battle about the structure of the solar system."[1849]

After Galileo was "officially silenced" in 1616, he "could not keep quiet for very long."[1850] He was too convinced of the truth, and he was too determined to bring that truth to the people. He could not stand idly by, while dogmatic beliefs and nonsensical philosophical systems reigned. He had a duty to expose the darkness to light. One event in particular strengthened his conviction: three comets in 1618 had frightened both "churchmen and public."[1851] When Galileo read Father Horatio Grassi's public lecture on the event, his temper flared. He quickly debunked such nonsense under a pseudonym. Galileo soon turned to a broader crusade for Copernicanism by publishing his *Dialogo*. Ley viewed it as a work of popular science that "was an immediate success with many people."[1852] He also quoted Giorgio de Santillana's *The*

[1846] Ibid., 119.
[1847] Ibid.
[1848] Ibid., 121.
[1849] Ibid., 123.
[1850] Ibid., 125.
[1851] Ibid., 126.
[1852] Ibid., 128.

Crime of Galileo, which summarized readers' reactions: "Meanwhile, the web of proof is being woven unobtrusively, until after a while the reader asks himself what kind of people could be blind to the evidence; what other opinion could be held except the Copernican?"[1853] According to Ley, "the literary public was delighted, [although] quite a number of Church Fathers were aghast." Galileo's critics were also horrified that the book was written in Italian "so that anybody could read it…" Ley clearly appreciated what Galileo tried to accomplish, and he expressed confusion at Urban VIII's negative reaction. After discussing various theories, he stated, "The only honest conclusion is that we don't know why Urban VII [sic] turned against Galileo." The Pope's reaction was irrational.

Nevertheless, in the proceedings that followed, it was clear that reactionary and anti-scientific forces mounted their dark chariots to strike the scientist down. As a devout Catholic, Galileo "had to submit to authority in some manner."[1854] Ley reiterated his support for de Santilliana's conviction that the "thundering theological persecution" disguised the real motives of Galileo's enemies.[1855] Ley quoted: "They could not very conveniently broadcast the real motives, which were that Galileo had taken to writing in Italian and that he had made them look foolish, or that the political meaning of it was that the Jesuits had evened up a score with the Dominicans by way of the new game of cosmological football."[1856] Ley even defended the legitimacy of a popular legend, in

[1853] Ibid., 129. Subsequent quotes in this paragraph are found on this page.
[1854] Ibid., 130.
[1855] Quoted on 131.
[1856] Ibid.

which Galileo defiantly says, "And yet, it moves."[1857] Readers are left with the impression that Galileo was a man lost in his age of backwardness.

With post-Galileo astronomers, Ley has a difficult time retaining the chronological narrative. In fact, much of the structure of the book became disjointed. Nevertheless, the remainder of *Watchers of the Skies* continued several themes. Astronomers are depicted as bold theorists, telescopic explorers, and fearless adventurers standing up to dogma, while educating the public. Quite often, mysterious comets or astronomical hoaxes panicked the public. Ley took aim at certain popularizers who exploited the fears. He also explored the ways in which astronomers even contributed to sensational reports. Ley concluded the book with an interesting discussion of the "Search for Other Civilizations." This epilogue brought a central narrative back into the text as Ley excited readers with the possibilities of extraterrestrial life. Ley wrote, "The search for other civilizations still has a chance to succeed—but only if we improve our equipment and move it out from under the blanket of our atmosphere."[1858] Astronauts would serve as the next generation of brave astronomers. A ship would soon depart.

Ley's "opus" to the history of astronomy arguably failed to bring a unity to the field. The scholarly tone of the text also convinced Moskowitz that the book was a "crushing disappointment" for Ley.[1859] He added, "The final product was huge, semi-scholarly, and largely unillustrated, and it merely unified in a readable format material already available. In contrast, his rocketry books had broken new ground, presenting

[1857] Ibid.
[1858] Ibid., 504.
[1859] Moskowitz, "Willy Ley in the U.S.A Part III: Losing the Last One," 20.

little-known and more sensational material."[1860] Moskowitz further claimed that, although the book went through five immediate printings, "Willy never got much money out of it." It had been a monumental project. Yet, "three years had passed… A dozen more profitable projects had been turned down or postponed."[1861] Ley had wasted time.

Moskowitz' tone is somewhat insulting, given that Ley was not attempting to write a bestseller. It also ascribes Ley's motivations to profit, as if his three-year devotion to the history of astronomy was a financial gamble. This perspective ignores Ley's true motivations for devoting himself purely to a project that contributed the history of science. It also ignores the fact that book was successful. Five back-to-back printings indicated that it was selling quite nicely. In fact the November 1963 issue of *Book-of-the-Month Club News* praised the book: "There is something here for everybody interested in the progress of human knowledge."[1862] The reviewer also stated, "Mr. Ley brings in an astonishing wealth of unexpected information."[1863] Owen Gingerich of the Smithsonian Astrophysical Observatory also complimented "the vast amount of scholarly researching and digging that has been spun into this imminently readable account."[1864]

The book was also well received by several historians of science. None other than I. Bernard Cohen praised the book in the *New York Times*.[1865] Cohen complimented Ley's "highly readable style that cannot fail to attract and hold the

[1860] Ibid.
[1861] Ibid., 19.
[1862] Basil Davenport, "Watchers of the Skies," *Book of the Month Club News*, November 1963, 8.
[1863] Ibid.
[1864] Owen Gingerich, "Watchers of the Skies," *Sky and Telescope*, September 1964, 164.
[1865] I. Bernard Cohen, "Guide for Space Travel," *NYT*, December 1, 1963, 496.

attention of all classes of readers…" Cohen stated, "I know of no other source for such authoritative and easily available information on the history of each of the planets as this new book." In Cohen's view, Ley's contribution to the scene included his discussion of "astronomical fancies," which "show us that on the edges of the scientific frontier, proper theory and fancy often mix and only later may be easily distinguished from each other." Cohen concluded with a salutation:

> As man prepares to embark on his first voyages into the solar system itself, this historical guidebook may well represent the ideal preparation for our understanding of the significance of this event. Many delighted readers will be grateful to Willy Ley for having provided them with so stirring an account that combines the virtues of readability and an awareness of the latest historical and scientific research.

Other reviewers commented on Ley's revelations. For example, Harry Schwartz wrote in the *New York Times*:

> Two points above all emerge from this fascinating volume. One is the frequency with which error and delusion have impeded astronomy; the history of that science is far from a simple unbroken progress upward toward greater understanding. The second is the remarkable brotherhood of astronomers over time and space that has resulted in our present knowledge being based on the work of men and women who have lived over thousands of years and who have belonged to almost every major branch of humanity.[1866]

"In the face of the universe," he added, "all men have been brothers, scientifically speaking at least."

Not all reviewers were positive. After Cohen praised the book in the *New York Times*, C. Doris Hellman remarked in *Isis*, "Whereas the book is recommended for the layman, it is not a reference book nor a book for the historian of science. The spritely, sometimes flippant style may grate on the student who won't like the way people are introduced… Nor will the student feel happy with the numerous minor inaccuracies and

[1866] Harry Schwartz, "Books of the Times," *NYT*, December 6, 1963, 32.

misprints…"[1867] At other times, "the scholar will winch…" One could read these types of comments as evidence of a changing of the guard.

A Changing Scene

One of the most curious aspects of Ley's *Watchers* is the absence of any reference to a book: Thomas S. Kuhn's *The Copernican Revolution* (1957).[1868] According to a later inventory of Ley's personal library, he owned the book, although it is unclear when he obtained a personal copy. We can only speculate as to why Ley discarded or overlooked the book as a secondary source. Nevertheless it is easy to imagine Ley reading the text with a critical eye. Kuhn claimed, "This book repeatedly violates the institutionalized boundaries which separate the audience for 'science' from the audience for 'history' or 'philosophy.'"[1869] Ley would have cringed at this statement as both a claim to a novel approach and an implicit recognition of "two cultures." Ley and other science writers had been mixing genres and audiences for decades. Kuhn also claimed, "Except in occasional monographs the combination of science and intellectual history is an unusual one."[1870] It is also easy to imagine Ley and others reacting to this statement. How could the works of Sarton, Butterfield, and others be labeled as specialized studies, when they often served as general and intellectual histories of science? Kuhn added: "Scientific concepts are ideas, and as such they are the subject of intellectual history. They have seldom been treated that way, but only because few historians have had the technical training to deal with scientific source materials."

[1867] C. Doris Hellman, "Review" *Isis* 55 (September, 1954): 377.
[1868] Thomas S. Kuhn, *The Copernican Revolution: Planetary Astronomy in the Development of Western Thought* (Cambridge and London: Harvard University Press, 1957).
[1869] Ibid., viii.
[1870] Ibid.

Although Ley would have probably agreed about the oversights of intellectual historians who ignored the history of science, he would have been baffled that a scholar could so easily dismiss a generation of intellectuals who had popularized the history of science as a fascinating mixture of revolutionary ideas, conceptual upheavals, and upstaged beliefs.

It is also interesting that Kuhn's most highly-praised book did not occupy Ley's bookshelves, according to a later inventory. In *The Structure of Scientific Revolutions* (1962), Kuhn argued that the history of science was mostly "a repository for… anecdote or chronology."[1871] Not only did earlier historians mislead readers, but they also failed to "to display the historical integrity of… science in its own time."[1872] They wrote "history backward."[1873] Kuhn even argued that their "deprecation of historical fact is deeply, and probably functionally, ingrained in the ideology of the scientific profession, the same profession that places the highest of all values upon factual details of other sorts."[1874] Kuhn went on to challenge the prevailing attitude that scientific progress resided in the gradual accumulation of facts and conceptual continuity. According to Kuhn, historians need to focus on the periods of revolutionary science, which led to new "paradigms." Science did not proceed in a straight line. Rather, cultural factors could explain how science might alter its course in a specific time and place. New theories were not simply extensions of older theories. It took bold adventurers who collected the anomalies together and crossed into unfamiliar territory, where they fearlessly explored the alternatives, questioned the underlying assumptions, and generally expressed their

[1871] Thomas S. Kuhn, *The Structure of Scientific Revolutions* (1962), 4th edition (Chicago and London: The University of Chicago Press, 2012), 1.
[1872] Ibid., 3.
[1873] Ibid., 138.
[1874] Ibid.

anti-authoritarianism under the threat of a dominant scientific establishment, which could be hostile, dogmatic, and totalizing.

Although Kuhn offered a general model that quickly became both controversial and influential, it should be obvious that many of these ideas were not new. Other historians had been using similar language for decades. As demonstrated, Ley's perspectives contained many of the key elements that contributed to a Kuhnian focus on conceptual shifts, scientific revolutions, and the influence of the "irrational" elements in the scientific process. Yet, how Ley's earlier perspectives contributed to this later historiographical revolution are unclear. Indeed, readers could legitimately wonder how Kuhn expressed confidence in the novelty of these perspectives and why many of his contemporaries did not point to an earlier generation of popular writers who championed anti-authoritarian depictions of scientists, while presenting the history of science as quite messy, revolutionary, and culturally dependent. Certainly, there were Whiggish elements, yet to characterize their histories of science as uncritical celebrations of the linear accumulation of facts was incredibly inaccurate. To use the label of "Sartonism" easily set up a "straw man" who was easily defeated.

This chapter can only hint at a possible explanation for the changing scene by building upon the suggestions of other scholars. Nevertheless, the task is important, because it helps to explain the increasingly cool reaction to Ley and other science writers in the 1960s. Although certain academics (most notably Kuhn) continued to attract large readerships, a growing disdain for popular histories found expression in pages of *Isis*. For example, Robert E. Carlson reviewed L. Sprague de Camp's *The Heroic Age of American Invention* (1961). Carlson admitted: "Written in the easy-to-

read style that characterizes many of de Camp's thirty or so books of fiction or non-fiction, this is a worthwhile beginning for those who seek an overview…"[1875] Carlson then implied that such a popular book fails at key historical tasks: "Too often the author is overtly concerned with the inventor's private life so that the economic and social environments in which these men lived receive only passing mention. Again, little effort is made to relate these environments to the need for and acceptance of these epoch-making inventions."[1876] De Camp's entertaining style seemed incompatible with the historian's demand for a more detailed examination of the broader socio-economic forces.[1877]

Other science writers could be harshly criticized. For example, Isaac Asimov moved from popularizing science to popularizing the history of science in *A Short History of Biology* (1964).[1878] Frederic L. Holmes criticized the nature of the book as unscholarly and simply too brief to serve as a worthwhile contribution to an academic field. Holmes stated, "…the brevity imposed on the individual topics necessarily produces frequent oversimplifications or inaccuracies."[1879] He then accused Asimov of advancing "distortions," "myths," and an overall Whiggish perspective that was ahistorical. When Asimov ventured further into the history of science in 1965, he produced *Asimov's Biographical Encyclopedia of Science and Technology*.[1880] It was a massive undertaking that culminated in a 662-page reference guide to the history of science and technology. An *Isis* reviewer coolly noted that the book was obviously

[1875] Robert E. Carlson, "Review," *Isis* 54 (March, 1963): 168-169. For a much more positive review of a different work by L. Sprague de Camp, see Bern Dibner, "Review" *Isis* 55 (September, 1964): 380-382.
[1876] Ibid., 169.
[1877] James Kip Finch made similar points in a review in the Winter 1962 issue of *Technology and Culture*.
[1878] Isaac Asimov, *A Short History of Biology* (Garden City, New York: The Natural History Press, 1964).
[1879] Frederic L. Holmes, "Review," *Isis* 56 (Summer, 1965): 228-229.
[1880] Isaac Asimov, *Asimov's Biographical Encyclopedia of Science and Technology* (Garden City, New York: Double Day, 1965).

meant for "a general reader with broad interests, not a basis for scientific research in the history of science and technology."[1881]

Willy Ley received a similar reaction to his translation of *Otto Hahn: A Scientific Autobiography* (1966).[1882] The book recounted the scientist's valiant struggles against a powerful and irrational regime, which expelled Lise Meitner from the scene of Aryan science. One of the book's central themes, in the words of a reviewer, surrounded the "evil political forces that nearly destroyed German science."[1883] Although the reviewer appreciated the central narrative of the text, he lamented the role of a science writer as translator and editor: "Unfortunately the book should have been more carefully edited and proofread."[1884] During these years, other historians cast a critical eye at scientific autobiographies as reliable historical documents.[1885] Autobiographies exemplified the problems of a scientist-turned-historian.

Ley's related attempt to promote Edward Topsell's compilation of Conrad Gessner's writings, *History of Four-Footed Beasts and Serpents*, was also coolly received.[1886] Although the reviewer appreciated Ley's intentions, he wrote, "Willy Ley's New Introduction is a popularized account, pleasant to read but containing some factual errors and lacking any documentation."[1887] Ley's approach lacked a scholarly diligence.

[1881] Josef Mayerhöfer, "Review," *Isis* 56 (Autumn, 1965): 369.
[1882] Otto Hahn, *Otto Hahn: A Scientific Autobiography*, trans. by Willy Ley (New York: Charles Scribner's Sons, 1966).
[1883] A. G. Maddock, "Review," *Isis* 58 (Winter, 1967): 583.
[1884] Ibid., 584.
[1885] See, for example, Brooke Hindle's review of Charles G. Abbot's *Adventures in the World of Science* (1958) in the summer 1962 issue of *Technology and Culture*. Many reviews of James Watson's *The Double Helix* could be equally critical.
[1886] *History of Four-Footed Beasts and Serpents*, vols. I and II by Edward Topsell, introduction by Willy Ley (New York: Da Capo, 1967).
[1887] Jerry Stannard, "Review," *Isis* 59 (Autumn, 1968): 335.

In other cases, historians began to identify certain writers as unwelcome outsiders to the field. This was particularly true of Arthur Koestler, whose 1959 *The Sleepwalkers* offended many historians of science. As a popular history of astronomy and cosmology, the book celebrated the irrational and unpredictable elements that led certain scientists to mindlessly drift in various directions, before they awoke somewhat dumbfounded by new discoveries and paradigm shifts. Koestler's portraits of individual scientists were often unflattering and quite provocative. Koestler sought to present individual scientists as "mental dwarfs" rather than intellectual giants. He also presented a rather totalitarian portrait of mainstream science, which hindered individual creativity and intellectual freedom. Modern science threatened romantic and spiritual values that should guide society toward a more humane future.

To the dismay of many historians (including Ley), Koestler's book became a bestseller. In their scathing denouncement of the book, historians Giorgio de Santillana and Stillman Drake admitted, "There are whole sections of public opinion for whom this work will put History of Science 'on the map' for the first time."[1888] The prospect was horrifying given Koestler's depiction of scientists as "antisocial schemers, cowards, liars, hypocrites, irresponsible cranks or contemptuous snobs." They were also shocked by Koestler's historical methods, which, in their view, could be seen as "impostures," deliberately deceiving readers with half-truths and long-discredited statements. Whereas Koestler's treatment of Copernicus "belongs more to the historical novel than to history," his account of Galileo was "simply dishonest."[1889] Santillana and Drake argued, "Widely read in the vast literature about Galileo, Koestler has threaded together

[1888] Giorgio de Santillana and Stillman Drake, "Arthur Koestler and His Sleepwalkers," *Isis* 50 (September, 1959): 255.
[1889] Ibid., 258.

every discredited charge, ancient and modern, that has been made against him, without the slightest attention to evidence in his favor on any of them."[1890] They concluded their review with these words: "…his thesis is utterly repugnant to everything we have written, and in contradiction with all that we have learned in course of years devoted to these studies."[1891] By 1965, historians were losing patience with the anti-totalitarian novelist writing histories of science. George Gaylord Simpson of Harvard stated bluntly: "Indeed, Koestler is wandering through well-charted lands without a map. It is possible to share his untutored zest, but that does not qualify him as a guide."[1892]

In other cases, a disdain for popular books reached a fever pitch. For example, the Smithsonian's Nathan Reingold reviewed William Gilman's *Science: U.S.A.* (1965).[1893] For Reingold, the book "suffers in comparison with the writings of better science journalists…" Reingold added, "too much of science writing is well characterized by the French term for popularization – vulgarization."[1894] Unfortunately, "historians cannot disregard the genre," because it contained useful clues from primary sources. In some ways, it would be better, Reinhold argued, if such a genre no longer existed. He announced, "Pity the poor future historian faced with a text lacking both bibliography and footnotes."[1895] He went on to make disparaging remarks about the intelligence of a science writer as compared to actual scientists. The popularizers were outsiders who could not be trusted. They vulgarized history.

[1890] Ibid.
[1891] Ibid., 260.
[1892] George Gaylord Simpson, "Review," *Isis* 57 (Spring, 1966): 127. This review concerns Koestler's *The Act of Creation* (New York: Macmillan, 1964).
[1893] Nathan Reingold, "Review," *Isis* 57 (Summer 1966): 275. See William Gilman, *Science: U.S.A.* (New York: Viking Press, 1965).
[1894] Ibid., 275.
[1895] Ibid.

Attempts to popularize the history of science through film were also derided in the pages of *Isis*. Most notably, David W. Chambers offered the following comments on the "Toulmin films," such as the short and educational *The Perception of Life* (1964).[1896] Chambers asked, "To whom, then, can such a film be recommended?"[1897] Because the "result is an anarchy of vaguely related images dazzling to the eye, bewildering," Chambers wrote, "In answer, I offer the spirit, if not the letter of a phrase quoted in *The Perception of Life*: 'Investigations of this kind particularly recommend themselves to ladies…'"[1898]

Other changing perspectives can be seen in the pages of *Isis*. A younger generation of historians focused a critical eye on a previous generation's political biases. For example, when Conway Zirkle extended his examination of the "death" of science in *Evolution, Marxian Biology, and the Social Scene* (1959), he faced a critical reception. As intellectuals reevaluated the relationship between Marxism and science in the post-Sputnik years, Zirkle's perspective seemed out-of-date. Scholar David Joravsky wrote, "Professor Zirkle is an angry man, and understandably so… he vents his smoldering anger on the founders of Marxism and on all those… who do not share his views on the biological determinants of history, on those who are 'dupes,' perhaps unwittingly, of 'Marxian biology.'"[1899] Joravsky highlighted "serious defects of his history," which too readily casts Soviet thinkers into authoritative camps of dogma. He also doubted the utility of the term "Marxian biology." Joravsky would soon publish a

[1896] David Wade Chambers, "History of Science on the Silver Screen," *Isis* 57 (Winter, 1966): 494-497.
[1897] Ibid., 497.
[1898] Ibid.
[1899] David Joravsky, "Review," *Isis* 51 (September, 1960): 348.

monumental study titled *Soviet Marxism and Natural Science, 1917-1932* (1961).[1900] It would not take long for other historians to reevaluate Soviet science.[1901]

Other books critiqued the historiography of science as "pseudo-scholarly." Most notably, Joseph Agassi's *Towards a Historiography of Science* pleaded: "…the study of the history of science is in a lamentable state: the literature of the field is often pseudo-scholarly and largely unreadable."[1902] Agassi went on to criticize the use of false dichotomies that separate "observation" from "superstition," as well as "fact" from "error." As the critique circulated, *Isis* reviewers increasingly used the label of "nonscholarly" to identify popular books written by practicing scientists.[1903] In other instances, a reviewer would express his or her surprise: "Although the presentation is popular, the authors are abreast of the latest scholarship in the history of biology."[1904] The dichotomy between popular and scholarly writing became implicit.[1905]

Meanwhile, Alexandre Koyré's *Mystiques, spirituels, alchimists du XVIe siècle allemand* (1955) began to widely influence historians in the early 1960s. The book presented a more sympathetic portrait of religious radicals and mystical thinkers. Historian George Mosse praised this new perspective: "Instead of seeing in Paracelsus a man caught in a web of superstition, the originator of anti-scientific philosophy… he

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[1900] David Joravsky, *Soviet Marxism and Natural Science, 1917-1932* (New York: Columbia University Press, 1961).
[1901] See the Autumn and Winter 1961 issues of *Technology and Culture*. In particular, see David Joravsky, "The History of Technology in Soviet Russia and Marxist Doctrine," *Technology and Culture* 2 (Winter, 1961): 5-10.
[1902] Joseph Agassi, *Towards a Historiography of Science* (The Hague: Mouton and Company, 1963).
[1903] See, for example, Deborah J. Mills, "Review," *Isis* 56 (Autumn, 1965), 373. This review discusses H. C. King, *Exploration of the Universe: The Story of Astronomy* (New York: New American Library, 1964).
[1904] Walter F. Cannon, "Review, *Isis* 56 (Autumn, 1965): 391. Cannon reviewed Julian Huxley and H. B. D. Kettlewell's *Charles Darwin and His World* (New York: Viking Press, 1965).
[1905] See also J. Brookes Spencer's review of D. K. C. MacDonald's *Faraday, Maxwell, and Kelvin* (Garden City, New York: Doubleday, 1964), in *Isis* 56 (Autumn, 1965): 392-393. See also Garland F. Allen's review of James Watson's *The Double Helix* (1968) in *Isis* 59 (Winter, 1968): 464-466.

reminds us that sixteenth-century magic was a science… Alchemy here was not the romantic aberration that Goethe publicized. "[1906] Koyré's style of reevaluating the importance of "pseudoscience" was not without precedent. This reevaluation had really begun a decade earlier, with Taylor S. Sherwood's *The Alchemists: Founders of Modern Chemistry* (1949).[1907] Yet, several historians initially revolted against the alleged "founding" of a modern science in a mystical "pseudoscience." For example, Wyndham Miles appreciated Sherwood's interest in such an overlooked topic. Nevertheless, the scientific founders of eighteenth-century chemistry were "a far distance to the puffers and philosophers of alchemy."[1908] As such, Taylor's book "traces the evolution of the pseudo-science," not the evolution of modern chemistry.[1909] By the 1960s, many scholars were far more receptive of such reevaluations. Historians of astrology also began to present more complex histories that did more than discredit the "nonsense." The history of science was becoming more academic, self-reflexive, and critical. Historians became far more concerned with a disciplinary objective, rather than a popular crusade.

Although Ley owned several of these books, he rarely incorporated these new perspectives in his own histories of science. Like other science writers, he simply kept writing popular books for popular audiences. He had many allies, particularly in Great Britain. Most notably, the Halls worked with New American Library to produce *A Brief History of Science*.[1910] This book continued the Halls' quest to celebrate the historical

[1906] George Mosse, "Review," *Isis* 51 (September, 1960): 361-362.
[1907] Taylor S. Sherwood, *The Alchemists: Founders of Modern Chemistry* (New York: Henry Schuman, 1949).
[1908] Wyndham Miles, "Review," *Isis* 41 (July, 1950): 238.
[1909] Ibid., 237.
[1910] A. Rupert Hall and Marie Boas Hall, *A Brief History of Science* (New York: New American Library, 1964).

"attack on tradition," as well as the triumph of science over "magic" and "the elements of the irrational."[1911] Marie Boas Hall's *The Scientific Renaissance* likewise argued that "out of the muddled mysticism of sixteenth-century thought and practice, the scientifically valid problems were gradually sifted out to leave only the dry chaff of superstition."[1912] An aging generation of historians praised the book widely. For example, I. Bernard Cohen remarked, "Historians of science have long lamented the lack of easily readable works in which the fruits of their research would be made available to introductory students and to the general historian."[1913]

Yet, at the same time that Ley and other writers continued to popularize uplifting and celebratory accounts, the scene was increasingly dominated by more critical voices. For example, astronomer Fred Hoyle published *Of Men and Galaxies* in 1964. Hoyle lambasted the rise of "big science," as well as the dangers of a scientific elite with too much power. The book passionately pleaded for the preservation of romantic settings, where exploration and aesthetic enrichment happened simultaneously. For example, Hoyle argued: "Walk into a big cathedral, and it wipes your brain clean of every thought. The same thing happens when you walk into these wonderful modern office blocks. The same thing happens all too easily in big science."[1914] Big science was stripping away the wonder, enchantment, and awe. These sentiments led the Smithsonian's Walter Cannon to argue that Hoyle "has really gone off the shallow end."

[1911] See A. Rupert Hall, *The Scientific Revolution* (Boston: The Beacon Press, 1954), xii.
[1912] Marie Boas Hall, *The Scientific Renaissance, 1450-1630* (New York: Harper and Brothers, 1962), 168. See also, *A. Rupert Hall, From Galileo to Newton, 1630-1720* (New York: Harper and Row, 1963).
[1913] I. Bernard Cohen, "Review," *Isis* 56 (Summer, 1965): 240.
[1914] Fred Hoyle, *Of Men and Galaxies* (Seattle: University of Washington Press, 1964), quoted in Walter Cannon, "Review," *Isis* 65 (Summer, 1965): 249.

Other writers were taking a critical turn. Most famously, the bestselling works of Rachel Carson pleaded for environmental protection and revulsion at modernist fantasies of the violent redesign of nature without an awareness of unintended consequences. Yet, it is fascinating how John Gatta's described Carson's "lifelong aspiration to blend scientific curiosity with a religiously indeterminate yet robust spirituality."[1915] As many other intellectuals turned critical eyes toward modernization theories, Western values, and the uncritical celebrations of science and its practitioners, other science writers, like Ley, labored forward or fought against the tide.

Dawn of Zoology

Throughout much of 1967 and 1968, Ley wrote a book that would serve as his second "opus" to the history of science, as well as his main contribution to the Prentice-Hall Series in Nature and Natural History. Ley titled it *Dawn of Zoology* (1968), because it explored the prehistory and evolution of mankind's thoughts about the natural world and its curious creatures.[1916] Editor and science writer/naturalist Joseph Wood Krutch introduced Ley's contribution to the series.[1917] Krutch made no apologies for including a "rocket expert" in the series.[1918] He advised his readers to forget what they may or may not know about Ley. Instead, they should consider him "only as a

[1915] Gatta, *Making Nature Sacred*, 11.
[1916] Willy Ley, *Dawn of Zoology* (Engelwood Cliffs, NJ: Prentice Hall, 1968).
[1917] For other contributions, see Rutherford Hayes Platt, *The Great American Forest* (Englewood Cliffs, N.J.: Prentice-Hall, 1965); Lorus Johnson Milne, *Patterns of Survival* (Englewood Cliffs, N.J.: Prentice Hall, 1967). See also, Paul B. Sears, *Lands Beyond the Forest* (Englewood Cliffs, N.J.: Prentice Hall, 1969); Peggy Pickering Larson, *Deserts of America* (Englewood Cliffs, N.J.: Prentice Hall, 1970). Judging by the number of American libraries that contain copies of this series, these books circulated widely. Ley's contribution was by far the most historical of the lot.
[1918] Joseph Wood Krutch, "Introduction," in Ley, *The Dawn of Zoology*, vii.

student of the development of zoology."[1919] One might wonder why Ley did not object to this line, considering both sides of his literary activities promoted future explorations of the great unknowns in nature. The two fronts were connected. Krutch also outlined Ley's clear agenda in countering a recent and trendy thesis in the history of science: "Mr. Ley avoids the too familiar thesis that all the sciences grew out of the pseudo-sciences—chemistry out of alchemy; astronomy out of astrology; zoology out of myth, fable and the search for moral meaning in natural phenomenon."[1920] Instead, Ley would show that "the desire to satisfy curiosity which had no ulterior purpose is the real father of zoology. His book will illustrate how such curiosity operated and how it often went astray before it achieved a correct answer."[1921] In other words, Ley presented a no-holds-barred attack on the "nonsense" that "real" science owed a debt to the irrational mysticism of medieval practices or the lingering stumbling blocks, blind alleys, and wrong turns. Ley would chart the gradual ascent of man's knowledge about the natural world, as well as the general transformation of "man the hunter" into "man the explainer."

Ley begins the text by taking readers into the furthest reaches of historical time in Northern Europe, when the "glaciers of the last stage of the Ice Age had then only recently withdrawn."[1922] Ley added, "a casual observer from another planet would have seen quickly that Man was on the road to mastery… due to the greater size, ability, and efficiency of the human brain."[1923] While Ley does not discount the role of hunting and breeding for primitive man's growing awareness of the animal kingdom, he dismissed

[1919] Ibid.
[1920] Ibid., viii.
[1921] Ibid.
[1922] Ley, *Dawn of Zoology*, 5.
[1923] Ibid., 6.

such practices as utilitarian. He argued: "The prehistory of zoology began with something entirely different—the discovery that there were curiosities."[1924] Man began to marvel. He also began to explore. Much later, with the Greeks, science began "with wondering."[1925]

Unfortunately, the broader quest to explore the world started with Herodotus who "did not do much investigating of his own."[1926] Although he was a "careful reporter," Herodotus "did not think it necessary to investigate stories about animals in detail; he may have felt that while somebody might lie when it came to politics or to finance, nobody would say something untrue about such a relatively unimportant thing as animals of a region."[1927] In Ley's mind, Herodotus did more harm than good. He argued, "Herodotus is responsible for quite a number of ridiculous stories, most of which were firmly believed for centuries to come."

Fortunately the scene would change during the 4th century B.C. when Aristotle became the chief explorer. Aristotle "studied animals for the sake of knowledge that his contemporaries probably deemed 'useless' and that was, as a matter of fact, useless in his time… nobody before Aristotle had even tried to be systematic in relation to animals."[1928] The text further praised Aristotle's independent thinking, after he broke with Plato and "began to pay more and more attention to facts"[1929] Aristotle "grew into a 'natural' philosopher." He "collected, dissected, and studied…" Other brave thinkers followed. Notably, Pliny the Elder carried the prehistory of zoology into a new

[1924] Ibid., 9.
[1925] Ibid., 10.
[1926] Ibid., 18.
[1927] Ibid., 18
[1928] Ibid., 10.
[1929] Ibid., 27. The next two quotes are found on this page.

millennium. He exemplified "man the collector," who "took stock of what was known…"[1930] His *Historia naturalis* represented his tireless efforts to write an encyclopedia about the natural world. In spite of its inaccuracies, as well as the uncritical inclusion of mythological creatures, Pliny the Elder's text served as an "indispensable book."[1931] It documented the efforts of a naturalist "on the trail of the unusual and remarkable."[1932] He offered his readers "a plethora of fabulous beasts…"[1933]

Ley did not fault Pliny for the inclusion of strange and mysterious beasts that have since been debunked. Both Pliny and Aelianus "did the best they could. They may have transmitted myths, but it was not their intention to do so."[1934] Ley then discussed the transition to "man the allegorizer," whose fictional fables, poetry, and other stories did little to aid the science of zoology. For example, the "sermonizing of the Physiologus must have struck the right note… [but as] far as the 'facts' are concerned it is without value and it certainly is not a literary or poetic masterpiece."[1935] Ley concluded the chapter with a lambasting of the works of Isidore who listed single-footed or backwards-footed tribes as "among the strange races of men…"[1936] He ended the chapter with these two lines: "Isidore listed the *Antipodes*—so called because their feet are backward! Such is the work of the 'last of the savants of the ancient world.'"[1937]

[1930] Ibid., 54.
[1931] Ibid., 43.
[1932] Ibid., 47.
[1933] Ibid., 51.
[1934] Ibid., 61.
[1935] Ibid., 65.
[1936] Ibid., 75.
[1937] Ibid.

Soon, darkness fell. Ley does not miss an opportunity to write about the "tragedy" that befell proto-zoology. In a long passage that illustrates his bitter assessment of medieval thinkers, Ley wrote:

> Somebody wrote a few decades ago that the life of Aristotle after his death has many of the elements of a tragedy, meaning that the people who proudly called themselves "Aristotelians" a millennium later did the opposite of what Aristotle would have expected or wanted them to do. Aristotle had always tried first to amass information, in many cases from his personal observations; to find common characteristics and then to attempt an explanation. The "Aristotelians" of a later date decided that the master's work contained all the information there was. One might hold lengthy discussions on the meaning of passages that had been obscured by time and poor copyists, one might dispute endlessly just which animal or bird was meant in a given passage, but most Aristotelians did not feel it necessary to add anything new. And, of course, once could never contradict anything Aristotle had said, even if it was by no means certain that it had actually been Aristotle who had said so. Somewhere Aristotle had said that the mayfly has four legs, hence mayflies had four legs, though anybody could catch a mayfly and find out in three seconds that it has six.

The medieval scholars were blinded to the world around them. They followed dogma uncritically. They possessed no real sense of wonder or sheer curiosity. Science could not progress. Instead, the age of darkness elevated "man the cleric."[1938]

Despite such sentiments, Ley offered some nuance. He clarified that the term "Dark Ages" was a label that obscured the complexities of the era. He wrote, "Everybody 'knows' that no advances of any kind were made… that learning was held to be without value and was discouraged and even actively suppressed."[1939] Ley added, "Everybody knows that a man with a new idea, like Christopher Columbus, had to fight superstitions and wrong geographical beliefs."[1940] Ley then tries to add finer points to the discussion. For example, much of the distaste for learning can be attributed to the millennialism between 500 and 1000: "The year 1000 was less than half a century away

[1938] Ibid., 77.
[1939] Ibid.
[1940] Ibid.

and many Christians were convinced that this year would mark the end of the world."[1941] A "superstitious" belief stood in the way of progress, and a "turning point" would not take place until 1003, after "the world had not come to an end and the Pope's example showed that learning and piety could be combined."[1942] In a surprising turn, Ley then noted how many key inventions occurred during the "Dark" Ages. He also highlighted a "whole catalogue of glittering names," such as Albertus Magnus, Roger Bacon, St. Thomas Aquinas, and Dante Alighieri.[1943] Nevertheless, darkness reigned.

Additionally, Ley quoted Sarton's description of Hildegardis de Pinguia as a nun who possessed "an encyclopedic mind of the mystical type."[1944] Ley took an in-depth look at St. Hildegard's *Physica* as a medical text relating to botany and zoology. He obviously enjoyed poking fun at the work's surprising prescriptions. Ley summarized: "She especially warns against the eating of strawberries (she may have been allergic to them), or of fresh fruit in general. Her chapter on mushrooms is one loud and long condemnation, with a few medical hints, all mistaken."[1945] Ley added to this summary: "Beer is the best drink ever invented; it is wholesome and good for all ages, except very small children, because the water in the beer has been 'cleansed by the power of fire,' and it is good and nourishing because it is really the 'juice' of grain."[1946] Ley then examined her discussion of the animal kingdom. More than many writers, she contributed to myths about the unicorn. Many of her zoological descriptions, he argued, were taken from the *Physiologus*. Ley also implied that she invented new details

[1941] Ibid., 78
[1942] Ibid.
[1943] Ibid., 79.
[1944] Quoted on page 81.
[1945] Ibid., 82.
[1946] Ibid.

surrounding the unicorn's fascination with virgins, particularly with young and attractive ladies of the nobility. Overall, Ley dismissed her contributions in a chauvinistic tone: "She was, no doubt, a 'holy abbess' with the common people and the minor clergy, as well as the nobility of her time. But the world of learned letters paid no attention to her until her writings were resurrected by churchmen in the nineteenth century, as part of ecclesiastical history."[1947]

Ley's description of emperor Frederick II was kinder, yet Ley argued that Frederick "is probably the only man who was excommunicated three times… As a person he was generous and expansive—and was promptly accused of being given to orgies."[1948] However, Frederick was also an avid learner who possessed "an absolutely insatiable curiosity, embracing everything from astronomy to zoology, especially zoology."[1949] Ley described a "typical day in Frederick's life," which included "checking on edicts, correcting a translation from Arabic made by one of his scholars, dissecting a bird, and dictating letters to Moslem rulers."[1950] The day might also include sending a diver to the bottom of the Strait of Messina "to tell him what lived down there."[1951] Ley presented Frederick as an internationalist in search of universal truths. Ley wrote, "His extensive correspondence with non-Christian rulers made him suspect, his unusual experiments even more so, and his insistence on a weekly bath was probably due to un-Christian influences too."[1952]

[1947] Ibid., 85.
[1948] Ibid., 86.
[1949] Ibid.
[1950] Ibid., 87.
[1951] Ibid.
[1952] Ibid., 88.

The remainder of *Dawn of Zoology* contained many of these themes, while celebrating the triumph of human curiosity during the Renaissance and beyond. As one would expect, the book moves from founding father to founding father, while glorifying wonder, mystery, awe, and the "human spirit" that could be liberated from dogmatic systems of beliefs. Ley's history of zoology is thus a history of the ascent of man. Ley explored many of the key primary sources in order to advance his central thesis: modern science emerged when human beings cast aside ulterior motives and authoritarian cults. The scientist embraced pure curiosity for curiosity's sake alone. This distinction, in the end, is Ley's counterattack to recent "trendy" thesis that blurred the lines between science and pseudoscience. The mystics had suspect motives and authoritarian masters. The scientists had pure motives and few restraints. Thus, the history of science offered a lesson in hope, liberation, freedom of thought, and the international exchange of ideas beyond borders and "curtains." Real science was heroic.

"Losing the Last One"

Ley's *Dawn of Zoology* was favorably received by working biologists and generally ignored by historians of science. For example, a high school biology teacher praised the book as a useful text for assigned reading, while *Isis* did not solicit a review.[1953] When historians did review the book, their tone was incredibly patronizing, indicating a complete dismissal of the role of a science writer as a historian of science. Most notably, Jerry Stannard reviewed the book for *Science*.[1954] He called the book "a

[1953] See William L. Yarber, "Review," *The American Biology Teacher* 31 (April, 1969): 272.
[1954] Jerry Stannard, "Review," *Science* 163:3862 (January 3, 1969): 64-65.

popularization, suitable as a Christmas gift but valueless to the scholar."[1955] Historian Theodore M. Brown of Princeton also dismissed the book as a curious artifact of past styles of writing. Ley's style and framework was old-fashioned and non-scholarly. Brown argued, "He seems to write out of the anachronistic conviction that science is mainly the accumulation of factual knowledge and that the history of science, as a result, ought to be devoted to the recounting of past 'errors' and first 'true discoveries.'"[1956] Brown continued: "Following this generally (and rightfully) abandoned conception of the task of the historian, Ley develops a chatty, semi-encyclopedic format…" Ley showed little awareness of the history of science as a "socially structured" and "historically evolving activity."

It is difficult to find other reviews of the book. Even the *New York Times* ignored it. Prentice Hall's less-than-stellar marketing campaign did not help sales of the book. Yet, considering that over 1000 university libraries possess the book today, it must have circulated quite widely. It was also translated into French.[1957] Nevertheless, *Dawn of Zoology* was personal failure for Ley. It was one of his most direct and scholarly contributions to the history of science, and historians ignored it.

The Sophistication of an Academic Discipline

Not only was Ley's style of writing out-dated, but his historical celebration of founding fathers and their "steps" was at odds with the ideals and standards of an emerging and academic profession. As the discipline of the history of science developed, it remained open to academics of diverse training in both scientific and

[1955] Ibid., 64.
[1956] Theodore M. Brown, "Review," *American Scientist* 58 (May-June, 1970): 335.
[1957] See Willy Ley, *Ces bêtes qui firent nos legends* (Paris: France-Empire, 1968).

humanistic disciplines. Yet, as it became far more institutionalized, it became less open to both science writers and scientists-turned-historians. Contemporary historians have celebrated this change for many good reasons. With the professionalization of the history of science, scholars began to tell more complex stories that chipped away at the caricatures of grand narratives and Enlightenment tropes. Medievalists, in particular, followed in the footsteps of Pierre Duhem (1861-1916) by discrediting the notion that the period was devoid of intellectual sophistication. Other scholars have spent decades challenging the "classical view of science," along with its traditional dichotomies between science and pseudoscience. There is little enthusiasm for uncritical and celebratory accounts, particularly when embellished histories widely circulate outside of the bounds of peer review. There is overt hostility toward practicing scientists who write "histories in which the discoveries of their own day were presented as the culmination of a long process of advancing knowledge and civilization."[1958] All encompassing visions of progress now reek of naiveté, or they simply represent ideological justifications for the social, political, and economic importance of science and its practitioners.

This divergence between scholarly historians and science writers would increase in the coming decades, although a few influential figures like Isaac Asimov, Stephen Jay Gould, and Carl Sagan would continue to navigate a middle world. Yet, by the 1970s, the contrasts could be jarring. In a retrospective article about the science writers, journalist Keay Davidson reflected on the sudden dichotomy.[1959] On one side stood

[1958] Jan Golinski, *Making Natural Knowledge: Constructivism and the History of Science* (Chicago: University of Chicago Press, 2005), 2.
[1959] Keay Davidson, "Why Science Writers Should Forget Carl Sagan and Read Thomas Kuhn: On the Troubled Conscience of a Journalist," in *The Historiography of Contemporary Science, Technology, and*

Thomas Kuhn, whose works were popular, yet intensely critical of Whiggish agendas and uncritical celebrations of science. Kuhn's many admirers and fellow travelers sought to purge their field of pseudo-history. On the other side stood Carl Sagan who "viewed science history as a saga of heroes vs. intellectual bigots and progress vs. superstition… One might describe his historical writings as a mixture of Sarton and Andrew Dixon White, plus a pinch of Arthur Koestler."[1960]

As an academic discipline, the history of science became far more self-aware and eager to celebrate its liberation from an earlier generation's baggage. By the 1980s, Jan Golinski summarized, "it was no longer possible to evade the conclusion that the traditional understanding of science had been radically undermined."[1961] Much of this progress should be attributed to the scholars of the 1960s. They challenged traditional narratives, cast a critical eye, and asked demanding questions that upset traditional hierarchies of knowledge. In the words of John R. G. Turner, the history of science became "too important to be left to the self-interested and distorted perceptions of the working scientists themselves."[1962]

Although it is easy for historians to celebrate these developments, perhaps the example of Willy Ley might lead to less congratulatory accounts of the institutionalization of an academic field. Certainly, it is easy and perhaps healthy to cringe when reading his histories of science today. Yet, it is equally easy to experience moments for pause and appreciation. Sympathetic historians could ask a provocative

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Medicine: Writing Recent Science, eds. Ronald E. Doel and Thomas Söderqvist (London and New York: Routledge, 2006): 15-30.

[1960] Ibid. 21.

[1961] Ibid., 9.

[1962] John R. G. Turner, "The History of Science and the Working Scientist," in *Companion to the History of Modern Science*, eds. R. C. Olby, G. N. Cantor, J. R. R. Christie and M. J. S. Hodge (London and New York: Routledge, 1990), 30.

question: What was lost in the process of professionalization, when the history of science transitioned from an open and cosmopolitan scene to an academic and institutional setting?

Other scholars have asked this question about their fields. For example, George A. Reisch's *How the Cold War Transformed the Philosophy of Science* (2005) took a fresh look at the early empiricists.[1963] Reisch discovered that many positivists sought "to cultivate epistemological and scientific sophistication among even ordinary citizens."[1964] Rather than promoting a detached objectivity and a value-free science, they campaigned for hearts and minds, while promoting value-laden justifications for scientific thinking. Reisch further illustrated how later critics deeply misunderstood or mischaracterized these activities and beliefs.

Thus, we can see a transition in the philosophy of science. During the 1930s and early 1940s, the philosophy of science flourished as a cosmopolitan and open discourse. Intellectuals became socially engaged, often writing for popular audiences. Yet, upon becoming a more respectable academic discipline during the Cold War, this commitment to social outreach declined, both due to academic isolation and the fact that populist activities of leftist intellectuals reeked of a past association with the Popular Front. The rise and fall of public intellectuals marked the emergence of their discipline, especially when a redefined logical empiricism of the 1950s tried to purge itself of social engagement and politics. In the transition to value-neutrality, the "cultural and social ambitions were lost."[1965]

[1963] George A. Reisch, *How the Cold War Transformed the Philosophy of Science: To the Icy Slopes of Logic* (Cambridge: Cambridge University Press, 2005).
[1964] Ibid., 3.
[1965] Ibid., 6.

Is it possible that this perspective may also apply to the history of science? While most historians of science no longer see the world in stark terms, perhaps the time has come to seek guidance from an earlier generation of writers who had a social cause to construct a world that was hospitable to science, democracy, progress, and reason. Despite their Whiggish interpretations, ahistorical outlooks, and general misconceptions about the history of science, they held very clear notions about the friends and foes of truth. They chose their battles wisely. They had a very real impact on the world in which they lived.

Conclusions: The First Citizen of the Moon

In January of 1968, Ley attended a cocktail party in Washington, DC. It was held to celebrate the tenth anniversary of the launch of Explorer 1. In a later issue of *Galaxy* magazine, Ley recalled the event: "What made the celebration even more joyous was the fact that Explorer-I was still in orbit; it is (and has been for a number of years) the oldest orbiting satellite."[1966] Ley joked, "Everybody that had anything to do with the project – including some who, like me, had only contributed moral support – was present, and the room reverberated with reminiscences."[1967] This statement is an example of Ley's modesty. One might recall his words to a future biographer in 1955: "I… would like to be held responsible to some extent for the coming age of space travel."[1968] Ley often minimized the extent to which he contributed to the scene. From his early days as a consultant to *Frau im Mond* and the German Rocket Society's chief publicist to the his later publications, interviews, consulting work, and even toys, Ley tended to speak incidentally about his efforts and successes. He appreciated the recognition of his efforts. He adored and preserved many of those recognitions, particularly letters from his younger fans. Yet, he summarized his role in the Space Age as merely contributing "moral support," as the real engineers and scientists did the hard work of overcoming engineering obstacles and designing the marvelous technologies of tomorrowland. At times, he felt left out of the really exciting and creative work. Yet, as he told Mike Wallace, he had a "good substitute."

[1966] Willy Ley, "The Orbit of Explorer-I," *Galaxy*, October 1968, 94.
[1967] Ibid.
[1968] "Ley, Willy," *H.W. Wilson World Authors, 1900-1950*, 1553.

By June of 1969, he had written dozens of books that excited audiences about an immediate future of human spaceflight. He had written hundreds of articles for newspapers, magazines, and newsletters. He had given hundreds of public lectures, meant to educate, entertain, and excite a crowd of curious onlookers. His influence could be seen everywhere, from television broadcasts to science fiction novels that used his *Rockets* as a technical guidebook. Indeed, it is difficult to think of a specific medium that Ley did not influence in some capacity. In addition to print and filmic/broadcast media, his publicity efforts included postcards, toys, exhibitions, rocket rides, and cereal boxes.

Ley was the most important and effective publicist for the Space Age, even during the early 1960s, when the celebrity status of von Braun peaked. Von Braun acknowledged this fact: "During the past thirty years he has done more than any man I know to carry the space message to the public, particularly to the younger generation. He deserves much credit for the space consciousness which has gripped the United States and which is the indispensable foundation of the American space program."[1969] Although Ley rarely designed or experimented, he engineered public support for a future of interplanetary travel. In spite of his outsider status, he effectively retained the title of a "scientist" and "rocket expert," who could educate millions of Americans about the field of rocketry and the cutting edge of space exploration. If historians consider the ways in which the history of spaceflight was a history of media as much as a history of technology and organizations, Ley becomes the most important historical actor of the scene. He directly and indirectly shaped both European and American "astroculture," with its "heterogeneous array of images and artifacts, media and

[1969] Wernher von Braun, "foreword," in *Beyond the Solar System*, iii.

practices that all aim to ascribe meaning to outer space while stirring both the individual and the collective imagination."[1970]

His closest friends and colleagues recognized his influence when Ley died of a heart attack on June 24, 1969, weeks before the lunar landing of Apollo 11. His family and friends were stunned. Consequently, their celebrations of the conquest of the moon were bittersweet. For Isaac Asimov, the situation was tragic and "ironic." He recalled, "Willy had spent almost his whole life wrapped in rocketry. He was the world's leading writer on the subject and from his teens he had had the one overriding ambition to see human beings on the moon—and he died six weeks before the attempt was to be made."[1971] Olga agreed, stating that the moon landing "was the justification of all his dreams," according to the *Los Angeles Times*.[1972]

Science writer Walter Sullivan reported: "Willy Ley, who helped usher in the age of rocketry and then became perhaps its chief popularizer, died yesterday… Mr. Ley lived to within one month of the scheduled fulfillment of his prophecy."[1973] Fritz Lang wrote a more emotional obituary for the *Los Angeles Times*.[1974] Lang praised Ley's efforts to make a dream become a reality. The moon landing, Lang implied, was the realization of Ley's dreams: "For him as to me, this day is the symbol of hope—the hope that other dreams born in the minds of other men, good dreams for a better future—will eventually become reality." Ley had worked to engineer that reality by campaigning for his dreams.

[1970] Alexander C. T. Geppert, "Introduction," in *Imagining Outer Space*.
[1971] Isaac Asimov, *In Joy Still Felt: The Autobiography of Isaac Asimov, 1954-1978* (Garden City, NY: Doubleday, 1980), 494.
[1972] "Willy Ley, 62, Space Travel Expert, Dies," *LAT*, June 25, 1969, 12.
[1973] Walter Sullivan, "Willy Ley, Prolific Science Writer, Is Dead at 62," *NYT*, June 25, 1969, 47.
[1974] Fritz Lang, "Sci-Fi Film-maker's Debt to Rocket Man Willy Ley," *LAT*, July 27, 1969, P24.

In the pages of *Galaxy*, Lester del Ray wrote an emotional obituary on the night before Ley's funeral. He lamented, "The world of science fiction has just lost its most important citizen. And—if histories are written by men of understanding—it may some day be realized that world has lost one of its singularly great leaders, surely a fact not readily apparent to some during his life."[1975] Del Ray further praised Ley's lasting contribution to the field of science fiction: "His popular books and articles on the hard facts of rockets, orbits, and space travel established the basic handling of such subjects. Writers who never read any of his early books on rocketry derived most of their facts from him through the stories by men who had studied his writings."[1976] For del Ray, Ley's legacy went beyond his influence on science fiction: "He took what must be the very basic dream with which science fiction began… And more than any other man, often by the least obvious means, he built that dream into reality."[1977]

In a special section of "correspondence," *Spaceflight* magazine presented several tributes. It included a short note from Chesley Bonestell, who stated bluntly, "Sir,--Willy Ley has gone. He probably did more than anyone else to make the public space conscious and to help man reach the Moon…"[1978] P. E. Cleator wrote, "…Ley, in one way or another, was so much a part of the astronautical scene that it is difficult to visualize it without him… his name will live on as one of the pioneers of that once supposedly fantastic enterprise, the making of a journey to another planet."[1979] A. V. Cleaver even foresaw dire consequence for NASA and the post-Apollo era: "With the death of Willy Ley… one of the greatest interpreters of astronautics was lost to

[1975] Lester del Ray, "Credo: The First Citizen of the Moon," *Galaxy*, September 1969, 151.
[1976] Ibid., 152.
[1977] Ibid., 153.
[1978] Chesley Bonestell, "Tribute to Willy Ley," *Spaceflight* 11, November 1969, 409.
[1979] P. E. Cleator, "Tribute to Willy Ley," 408.

mankind, at a time when the need for better understanding of the aims and possibilities of spaceflight is critical."[1980] Although Ley was on the outside of the institution, his loss would have a dramatic effect, unless a new popularizer could take his place.

In his obituary, del Ray added, "He was more than a prophet without honor. Events did not pass him by. Rather, he shaped them."[1981] Again, according to this perspective, Ley had engineered the Space Age: "It was largely Willy's work that killed the public antipathy to rockets after their use as a terror weapon and began to make people dream of space again."[1982] More than any other figure, Ley was a visioneer who influenced public opinion. "Somehow, through all his articles," del Ray concluded, "Willy and those who were converted by him had managed to convince half of the nation that there was value enough in the space program for them to go along with the huge expenditure… And step by step he led them to turn their eyes from this single planet to the vast reaches of space."[1983] Del Ray ended his emotional obituary with these words: "It took him forty years and he missed his goal of seeing the first man on the moon by a month. But there is precedent for that… *And Moses went up from the plains unto the Mountain… And the Lord showed him all the land… And the Lord said unto him… I have caused thee to see it with thine eyes, but thou shalt not go over thither*."

Putting aside this biblical language, one could argue that, in some ways, not only did Ley witness the moon landing, but also he reached the moon. In 1928, he had walked on Lang's movie set. In 1969, a commission agreed to name a crater on the dark

[1980] Ibid.
[1981] Del Ray, "Credo," 156.
[1982] Ibid.
[1983] Ibid., 156-157.

side of moon in Ley's honor. In a fitting tribute, Ley's moon crater can be viewed as an intermediary site between craters named after scientists, engineers, and science fiction authors. For forty-three years, he had acted as an intermediary, who took his readers and audiences into space, whether as passengers on a Disneyland rocket or eyewitnesses to the first black and white photograph-like paintings of the lunar landing. Millions of American children and young adults, through the consumption of Ley's words and representations, also made the journey through imagination. Millions of Americans experienced the journey to the moon during the 1950s in an imaginative and thrilling way. Watching the event occur live in 1969, it could be argued, was a far more passive experience, especially for young adults coming of age during a time of social unrest, continued civil rights struggles, and the Vietnam War. The actual moon landing may have seemed anachronistic or out-of-place. An interesting social study of this group and somewhat older individuals might ask a relevant question: During the moment of touchdown, did you feel immense hope for the future or a lingering nostalgia for a childhood of rocket dreams, space cadets, and 1950s optimism? Among a younger generation that followed Apollo with great enthusiasm, similar questions would later be asked.

For example, in her 2003 book, *Rocket Dreams*, scholar Marina Benjamin recalled her childhood experiences as a "space fanatic," whose "space-related hopes were boundless."[1984] Upon revisiting the site of Apollo thirty years later, she was struck by several retrospective questions: "Other questions were more reflexive in nature, as they threaded back into my childhood dreams and threatened to expose them as

[1984] Marina Benjamin, *Rocket Dreams: How the Space Age Shaped Our Vision of a World Beyond* (New York: Free Press, 2003), 2-3.

delusions, or else reminded me why so many of us once invested so much in NASA's dream peddling."[1985] She asked: "Was I naïve to believe we'd simply hop from the Moon and thence to the stars? Or did the prospect of leaping off the planet really speak to some deep-seated urge in the human soul?"[1986] She then asked if she had been a "dupe" or a "co-conspirator." She wondered how so many Americans could have invested such faith in what now seems utterly fantastic and unrealistic. She partly answered these questions by explaining how "we internalized our outward-bound aspirations, even before it became clear that human life would not be expanding across the solar system any day soon."[1987] The urge to reach out and "somehow get beyond the known world" did not disappear. For Benjamin, the story is one of transference, from Space Age dreams to extraterrestrial hopes and finally to cyberspace and virtual worlds, which now serve as our contemporary equivalent of an earlier Space Age. She argued, "…cyberspace has proved to be as engrossing an elsewhere as outer space, and it is both capacious enough and sufficiently 'real' for it to accommodate an almost wholesale transplanting of our extraterrestrial ambitions."[1988] The Space Age finally died when the Internet Age began.

Ultimately, the Space Age had failed to provide experiential fulfillment, in a way that satisfied a need for transcendence. Nevertheless, for a short time, it did temporarily satisfy romantic and spiritual yearnings. At every turn from 1970 to the present, Benjamin identified a combination of religiosity, mysticism, fanaticism, scientific worship, and technological fetishism. When reality crushed our cultural and

[1985] Ibid., 2.
[1986] Ibid., 2-3.
[1987] Ibid., 4.
[1988] Ibid., 204.

spiritual ambitions, we began to inhabit virtual reality that offered fewer constraints, along with more opportunities for cultural rebirth through utopian communities of like-minded individuals. Unless some miracle technology of the future allows for safe and convenient journeys to other worlds, we have a wholly satisfying alternative. Rocket technologies and even the international space station have been dwarfed by media technologies that deliver fantastic results that match social expectations.

Arguably, this account somewhat over-privileges escape, community-building, and utopian hopes rather than the fundamental motivations. In *Critical Issues in the History of Spaceflight* (2006), Roger D. Launius presented a list of rationales that often motivated many enthusiasts like Ley.[1989] These rationales include five themes: 1. Human destiny/survival of the species, 2. Geopolitics/national pride and prestige, 3. National security and military application, 4. Economic competitiveness and satellite applications, and 5. Scientific discovery and understanding.[1990] Of these five themes, Ley's books, articles, and related media fit most squarely with human destiny (albeit without the survivalist rhetoric), national pride and prestige (albeit with "Western" connotations), satellite applications (without the stress on economic competition), and scientific discovery and understanding. The last theme of discovery and understanding was the most important, because it related to the "fundamental drive" that united all free-thinking human beings throughout time and space. For Ley, a longing for "discovery and understanding" was the engine of all history, from Babylon to the Space Age. It was an international story that unified humankind.

[1989] Roger D. Launius, "Compelling Rationales for Spaceflight: History and the Search for Relevance," in *Critical Issues*, 38-70.
[1990] Ibid., 44.

This glorification of science and exploration was incredibly modernist and futuristic. In fact, scholars may be tempted to use the term of "astrofuturism," as analyzed by scholar De Witt Douglas Kilgore in *Astrofuturism: Science, Race, and Visions of Utopia in Space* (2003).[1991] Indeed, Kilgore placed Ley firmly in a "first generation" of astrofuturists. Collectively, this camp of science and science fiction writers promoted a common vision of space exploration, ripe with frontier imagery, capitalistic fantasies, and dreams of cultural rebirth. Kilgore argued, "Astrofuturist speculation on space-based exploration, exploitation, and colonization is capacious enough to contain imperialist, capitalist ambitions and utopian, socialist hopes."[1992] Kilgore added:

> Visions of an American conquest of space go hand in hand with thought experiments seeking some barely glimpsed alternative to the economic and political problems that dominated the twentieth century. Astrofuturism posits the space frontier as a site of renewal, a place where we can resolve the domestic and global battles that have paralyzed our progress on earth. It thus mirrors and codifies the tensions that characterize America's dream of its future.[1993]

One of Kilgore's most direct claims about Ley stressed how his earlier *The Conquest of Space* (1949) presented "the space frontier as a natural extension of Western and, therefore, American culture."[1994] He then explained: "For Ley, the conquest of space is mandated by natural and historical law, ordained in the same fashion as the European conquest of the New World. Support for this teleology comes from his understanding of history as the advancement of Western science and technology."[1995] Kilgore labeled

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[1991] De Witt Douglas Kilgore, *Astrofuturism: Science, Race and Visions of Utopia in Space* (Philadelphia: University of Pennsylvania Press, 2003).
[1992] Ibid., 1.
[1993] Ibid., 1-2.
[1994] Ibid., 74.
[1995] Ibid.

Ley's "teleology" as "a technological manifest destiny."[1996] It was an imperialistic vision of conquest through inevitable technological leaps into a strange, new frontier.

Ley's perspectives can also be related to a camp of "visioneers," as explored recently by W. Patrick McCray.[1997] In *The Visioneers*, McCray argued that the proponents of this camp of scientific intellectuals "imagined building a limitless tomorrow that sidestepped catastrophist scenarios of the future to offer endless space to expand, abundance of resources, and, in the most radical visions, the possibility of transcending the mortal limits of the human body."[1998] Although McCray analyzed how many of these individuals promoted their scientific and engineering fantasies in the 1960s and 1970s, it would be easy to place Ley in the context of the broader scene, in which the "visioneers' hybrid nature—a combination of futurist, researcher, and promoter—and the influence they sometimes attain compels us to consider how they interact with other actors in broader systems of technological innovation."[1999] Ley exemplified a scientific career on the "blurry border between scientific fact, technological possibility, and optimistic speculation."[2000] The visioneers "imagined futures, shaped by technologies they helped promote…"[2001] Space would be a limitless and plentiful American frontier. Like many of the key actors in Marina Benjamin's *Rocket Dreams*, Ley spoke "in grandiose terms of humanity entering a new age through the conquest of space…"[2002]

[1996] Ibid., 76.
[1997] W. Patrick McCray, *The Visioneers: How a Group of Elite Scientists Pursued Space Colonies, Nanotechnologies, and a Limitless Future* (Princeton: Princeton University Press, 2013).
[1998] Ibid., 9.
[1999] Ibid., 14.
[2000] Ibid., 17.
[2001] Ibid., 16.
[2002] Benjamin, *Rocket Dreams*, 101.

Although scholars will continue to analyze frontier imagery, teleological narratives of progress, and utopian hopes, it is important to recognize the matter-of-fact nature of the claims, at least in the minds of some historical actors. Ley never spoke of a grand vision for cultural rebirth. His imaginings of lunar or Martian colonies were not influenced by radical politics or utopian dreams of social harmony. Instead, Ley presented a rationale for spaceflight that assumed the form of a syllogism, as described by Stephen J. Pyne: "The urge to explore is a fundamental human trait. Space travel is exploration. Therefore, sending people into space is a fundamental characteristic of our species—what more is there to say?"[2003]

Although this rationale does not satisfy historians, it satisfied Ley. Often, he reiterated the universal drive of man to explore the great unknown, simply because it was a great unknown. Most notably, in a tense *Night Beat* interview, Mike Wallace asked Ley: "Why do you want to go into outer space? What's your fascination with it?"[2004] "Well," Ley answered, "you have the old answer to the question of why do we want to climb Mt. Everest: Because it is there… it is a basic drive." Ley added, "Man was born a curious animal." Wallace then quoted a scholar who argued that the conquest of space related to man's attempt to find "symbolic satisfaction for erotic or aggressive needs. It's just as basic as sex… the urge to explore, and to manage what we explore is a human urge as fundamental as the urge to procreate." Wallace asked Ley, "Well, what about it?" Ley responded: "Well he is probably right. I mean, I wouldn't

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[2003] Stephen J. Pyne, "Seeking New Worlds: An Historical Context for Space Exploration," in *Critical Issues*, 8. Historian Asif Siddiqi elaborates on this fundamental view as it shaped Ley's perspective on history and its space pioneers: "reason was combined with a modern version of manifest destiny, a marriage of the near-spiritual urge to explore new frontiers and the cold, hard rationale of technology." See Asif A. Siddiqi, "American Space History: Legacies, Questions, and Opportunities for Future Research," in *Critical Issues*, 436.

[2004] *Night Beat*, 12:55-13:00. This program aired on July 2, 1957. See "On Television" *New York Times*, July 2, 1957, 55.

have phrased it this way… I probably wouldn't have thought of it this way." Ley then summarized his own perspective by invoking historical parallels: "People of curiosity went after things with amazing results."

Von Braun similarly argued, "Man's restless mind is not easily discouraged by obstacles. On the contrary, the higher the obstacles the greater the challenge for man to climb over them. Scientific progress is wrought by each new generation of scientists, who stand on the shoulders of their predecessors… all obstacles, no matter how high, will ultimately be overcome."[2005] According to von Braun, it did not matter that the closest star system was over four light years away. What had seemed fantastic in the 1920s became a reality in the 1960s. Therefore, what seemed fantastic and impossible in the 1960s would actually happen in the 1990s. Von Braun added, "a thousand-mile journey begins with a single step."[2006] As noted, Ley also believed that a manned journey to Alpha Centauri would happen "at a time when people now alive (though very young) will be able to watch the take-off on television—say, half a century from now [in 2014]."[2007] It did not matter that something was currently impossible from a scientific or technological point of view.

These claims were more faith-based than empirical. They expressed faith in the human spirit. They also related to a broader view of science. Although Ley glorified science as the only direct and reliable path to knowledge, this vision was not "scientistic," according to contemporary definitions of the term. For example, in "The Origins of Scientism," political philosopher Eric Voegelin defined scientism as "the assumption that the new science could create a world view that would substitute for the

[2005] Von Braun, "Introduction," in *Beyond the Solar System*, xiv-xv.
[2006] Ibid., xiv.
[2007] Ibid., xix.

religious order of the soul."[2008] Scientism privileged dogmatic reductionism, scientific hierarchies, and rules of methodology that stripped away subjective and experiential forms of knowledge. Voegelin wrote, "The creed implies two great denials: it denies the dignity of science to the quest for substance in nature, in man and society, as well as in transcendental reality; and, in the more radical form, it denies the reality of substance."[2009] Voegelin went on to label scientism as a "decisive ingredient" in positivism, neopositivism, communism, and fascism, because each movement attempted to "treat substance… as if it were phenomenon."[2010] Each movement included an "antispiritual revolt" and "civilizational destruction."[2011]

Certainly, Ley would have agreed with some of the core principles, as more recently summarized by Mikael Stenmark. Ley belonged to a camp of scientific intellectuals who would have argued "that there are no real limits to the competence of science, no limits to what can be achieved in the name of science."[2012] Ley could also fit well with "some forms of scientism [that] seem to offer a substitute for traditional religions and thus present science itself as a religion or world view." He would have agreed that the "only sort of knowledge we have is the scientific kind of knowledge."[2013] Yet, there are deep tensions between a dogmatic materialism that privileges methodology and reductionism and Ley's "romantic naturalism." Rarely did Ley speak about a scientific method. He spoke instead about experiential moments of human creativity and curiosity, in which many of the key explorers were rule-breakers

[2008] Eric Voegelin, "The Origins of Scientism," *Social Research* 15 (December, 1948): 462.
[2009] Ibid., 462-463.
[2010] Ibid., 463-464.
[2011] Ibid., 464.
[2012] Mikael Stenmark, "What is Scientism," *Religious Studies* 33 (March, 1997): 15.
[2013] Ibid., 20.

and system-destroyers. Rarely did Ley reinforce hierarchies, in which laboratory and institutionalized science privileged the physical sciences and mathematics. Instead, Ley celebrated the journey, whether it involved the nighttime explorations of a daring astronomer or the jungle adventures of a daring naturalist. Rarely did Ley reduce all knowledge to individual and measurable parts. He built up from a complex and interdisciplinary web of truths to create a mosaic of the universe that inspired wonder, awe, and moments of spiritual transcendence. The psychological dimensions of experience could be profoundly important for scientists and non-scientists. Science was also laden with human values.

If we want to understand how Ley and others could have so faithfully believed in an immediate future of interplanetary exploration, with lunar and Martian colonies, along with the amazing discoveries that would change the world, we have to understand his perspective. It is also what unites all of Ley's works: A fundamental faith in the ability of humanity to overcome unthinkable obstacles, to conquer biological and environmental disadvantages, and to someday discover the true web of interconnection that unified the cosmos. One could rephrase this pursuit as the quest for "the meaning of life."

This quest is fueled by unequivocally modernist hopes and dreams of a better tomorrow, as mankind continues to transcend the boundaries and evolve as a biological species. It includes grand visions of reshaping the earth or other worlds, of somehow harnessing forbidden resources to alleviate social ills, and of conquering nature for the benefit of all humankind. The story of humanity was an adventurer's tale out of the darkness and into the light. The journey becomes the site of investigation, as brave

explorers dare new and unforgiving frontiers. At some point, the "saltation" will occur. Human beings will ascend like the brave reptiles that boldly crawled out of the ocean. Given the human spirit of curiosity in the presence of unknowns, bravery in the face of danger, and defiance of boundaries once taboo, this saltation will be a story of human destiny. Humans will transcend the limitations. As summarized by historian Alexander C. T. Geppert, this rhetoric exemplifies how images of spaceflight and outer space were "intimately bound with notions of modernity and utopian visions of human progress."[2014]

Benjamin is absolutely correct to highlight how these modernist dreams combined science and technology with romanticism, mysticism, religiosity, spirituality, and a quest for wholeness (which she sees in community-building and utopian dreams). Spaceflight advocates were spiritual individuals. Even self-proclaimed atheists like Carl Sagan preached a transcendental gospel, while calling science "informed worship."[2015] The language could easily become evangelical in tone. Von Braun, for example, wrote: "We live in an age of scientific onslaught against the remaining ramparts of ignorance about the creation. And there is plenty of evidence that the Creator does not mind when we try to comprehend fully His master plan."[2016]

For thinkers like Ley, the history of science was not a story of detached objectivity, the mechanization and simple rationalization of nature, and disenchantment with the profound mysteries that may be beyond our understanding. Instead, the history of science is a history of defiant explorers whose tales included apprehension, fear, and

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[2014] Alexander C. T. Geppert, "Introduction," in *Imagining Outer Space*.
[2015] See Carl Sagan, *The Varieties of Scientific Experience: A Personal View of the Search for God*, ed. Ann Druyan (New York: Penguin, 2006).
[2016] Von Braun, "Introduction," in *Beyond the Solar System*, xv.

especially awe, as the scientists confronted the complexities of nature, the sheer beauty of the untamed frontier, and the power of the aesthetic to communicate the adventure. They celebrated the individual heroism of the scientist/adventurer. They glorified the imagination of those heroes. Freedom, creativity, and scientific discovery intermingled. So too did fantasy and realism. Science and technology were the products of creativity and playful imagination. Science, overall, was not a specific "method" done in a sterile site of isolation. Instead, a voyage departed. Or, a mind simply dreamed.[2017]

Arguably, the label of "romantic modernism" aptly characterized both Ley's works and spaceflight media throughout the twentieth century. Hopefully, future scholars will confirm if this label can be applied more broadly to American popular science and natural history beyond the 19th century. Perspectives are moving in the direction. James Gilbert's *Redeeming Culture: American Religion in an Age of Science* documented an extraordinary degree of "admixtures of religion and science in cultural artifacts at all levels of society."[2018] He explored a "dialectical interaction," in which "the constant interchange between these two supposed polarities constitutes a powerful element in mastering the challenges of cultural and social change."[2019] Gilbert devotes an entire chapter to von Braun, which implicitly argues that von Braun's status as a born-again Christian helps to explain the imagery at work in spaceflight media.

Although many of Gilbert's specific claims about von Braun and Ley are incorrect, his perspective has been shared by other scholars who have questioned the

[2017] The glorification of the role of imagination may be a dominant theme in popular biographies of scientists. For example, see Geoffrey Cantor, "The Scientist as Hero: Public Images of Michael Faraday," in *Telling Lives in Science: Essays on Scientific Biography*, eds. Michael Shortland and Richard Yeo (Cambridge: Cambridge University Press, 1996).
[2018] James Gilbert, *Redeeming*, 3.
[2019] Ibid., 323.

traditional lines of demarcation in intellectual and cultural history. The work of Michael Saler is perhaps the most sophisticated reevaluation of a type of attitude that blended modernism and romanticism. His most recent book, *As If*, fits nicely with some of Benjamin's claims about the role of virtual worlds. According to Saler, "The modern West has been called 'disenchanted,' but that is a half-truth. It can be equally deemed an enchanted place, in which imaginary worlds and fictional characters have replaced the sacred groves and tutelary deities of the premodern world."[2020] One could extend many of Saler's claims to the Space Age and the consumption of imaginary worlds of the future. As noted in the introduction, Saler argued that the "vogue for imaginary worlds" in the twentieth century "is best explained in terms of a larger cultural project of the West: that of re-enchanting an allegedly disenchanted world." These virtual worlds offered a soothing mixture of rationality and imagination. Wonder, awe, and the sublime did not contradict a scientific worldview.

In a remarkable way, historians of spaceflight are pioneering an approach that recognizes many of the transcendental hopes of technophilia. Most recently, Alexander C. T. Geppert introduced the contributions of *Imagining Outer Space: European Astroculture in the Twentieth Century* (2011).[2021] He wrote, "Historicizing the Space Age… promises to shed new light on the modernity of an allegedly secularized century…" Building from the work of previous scholars who have long recognized the romantic and transcendental associations in spaceflight media, new scholars are continued to break down traditional distinctions.[2022] Much more scholarship must be

[2020] Saler, *As If*, 1.
[2021] Alexander C. T. Geppert, "Introduction," in *Imagining Outer Space*.
[2022] See also, Megan Prelinger, *Another Science Fiction: Advertising the Space Race, 1957-1962* (New York: Blast Books, 2010).

done before we can make definitive conclusions. Nevertheless, it is hoped that a detailed portrait of the works and career of one of the most influential science writers of the twentieth century lends support for the claims of other scholars. His brand of popular science mixed genres. He combined science with wonder, reason with faith, reductionism with holism, and technology with subliminal awe. He had a broader cultural project of re-enchanting an allegedly disenchanted science. While he offered a spiritually fulfilling appreciation of the mysteries of Nature and the ascent of mankind, he celebrated the human spirit in a way that put human beings in control of their own destiny. His explorers, as well as his readers, were not the pawns of big science or the victims of a technological maelstrom. The explorers bore little resemblance to Dr. Frankenstein or the Invisible Man. They were not consumed by their power and prestige, while single-mindedly pursuing a quest with disregard for the social consequences. They were not haunted or plagued by their successes. Instead, they were selfless explorers driven by an inescapable urge for discovery. They fantasized about the ways in which science and progress would create a new future, in which new discoveries could pay for everything, alleviate the need for conflict, and create brave, new worlds. Human agency still mattered. The explorer was in control. Human beings would shape human destiny.

Arguably, these tropes can help to explain how the Space Age was exemplified by the image of the astronaut. Despite the centrality of big science and complex networks of organizations and contractors, the heroic figures of the endeavor were adventurers, displaying bravery in the face of danger as they crossed into the endless frontier. Scholars have begun to analyze the image of the astronaut in more complex

ways. For example, Roger Launius listed five components to the "myth" of the astronaut: the "everyman," "defender of the nation," "fun-loving young man," "virile, masculine representation of the American ideal," and "hero."[2023] More recently, other scholars have begun to analyze representations of the "spacefarers," as done in an edited collection called *Spacefarers: Images of Astronauts and Cosmonauts in the Heroic Age of Spaceflight*.[2024] These scholars have studied images of American astronauts in terms of a postwar crisis of masculinity, the reassertion of frontier imagery, and the continuity with traditional images of flying aces. Matthew Hersch, in particular, contrasts the image of American scientists with American fighter pilots, to show that a more masculine and militaristic image won out.[2025] Hersch argued that the space pilot became "increasingly defined not as an emotionless 'systems man' but as a gruff and grizzled aviator able to steer complex machines with the nudge of a control stick."[2026] Not only did this image suit Americans' preference of a "romanticized version of NASA's achievements," but it also represented "the nation's proud legacy of individualism and heroic exploration." Hersch further explored fictional media, in which the scientist aboard the spaceship was often depicted negatively, in contrast to the heroic pilot. The scientists were often alien, robotic, or "merely creepy." Space scientists were villains, while the piloting astronauts remained heroic and virtuous.

Indeed, it is quite telling that at the height of big science, with its NASA technicians and governmental bureaucrats, Americans embraced the image of the

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[2023] Roger D. Launius, "Heroes in a Vacuum: The Apollo Astronaut as Cultural Icon," *Florida Historical Quarterly* 87 (Fall, 2008): 147-209.
[2024] *Spacefarers: Images of Astronauts and Cosmonauts in the Heroic Age of Spaceflight*, ed. Michael J. Neufeld (Washington, DC: Smithsonian Institution Scholarly Press, 2013).
[2025] For further reading, see Matthew H. Hersch, *Inventing the American Astronaut* (New York: Palgrave Macmillan, 2012).
[2026] See Matthew Hersch, "'Capsules are Swallowed': The Mythology of the Pilot in American Spaceflight," in *Spacefarers*.

astronauts as "tough, anachronistic pilots for whom spaceflight remained a daring adventure." In the same book, James Spiller stressed the presence of two different versions of the "mythic American frontier hero."[2027] In particularly, the Mercury astronauts took on personas as "frontier trailblazers," while the shuttle astronauts represented "frontier settlers." These images fit well with other scholars' analyses of the blending of frontier imagery and futuristic technologies.[2028] It would be interesting for a future scholar to bring in the image of the eighteenth century explorer or the nineteenth century naturalist.

Overall, many cultural representations of spaceflight have combined nostalgia and futurism, along with other motifs that have been staples of natural history and popular astronomy. The longevity of representations should indicate that American (or transnational) popular culture can provide a starting point to chart an indigenous, amateur, outsider, or people's science that flourished in the twentieth century. It remained open, while it mixed genres. It resisted and fought back against hierarchies of knowledge. It appealed to Americans because it reflected American values. Thus, it makes sense that when the shock of Sputnik created demands for large-scale hierarchies of knowledge production, American embraced representations that re-enchanted big science. The most modern accomplishment of science and technology had to still be a romantic adventure with a romantic adventurer. Willy Ley would have agreed.

[2027] James Spiller, "Nostalgia for the Right Stuff: Astronauts and Public Anxiety about a Changing Nation," in *Spacefarers*.
[2028] In particular, see Megan Prelinger, *Another Science Fiction: Advertising the Space Race, 1957-1962* (New York: Blast Books, 2010).

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