At the Frontiers of Science:
An American Rhetoric of Exploration and Exploitation in a Postcolonial Transnational Context

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This is a prospectus for a scholarly book on the use of the "science is a frontier" metaphor in speeches, popular books, and op-ed essays by American scientists and politicians, and the implications of this language use in a postcolonial transnational context. Summaries of the chapters are presented below.

Chapter 1: Introduction

As historian Patricia Nelson Limerick puts it, the term "frontier" to Americans is "virtually the flypaper of our mental world; it attaches itself to everything" despite the fact that the frontier myth is "jammed with nationalistic self-congratulation and toxic ethnocentrism."[1] While "clear and predictable on most occasions, the idea of the frontier is still capable of sudden twists and shifts of meaning, meanings considerably more interesting than the conventional" connotations it engenders.[2] My book exposes some of these twist and shifts of meaning, particularly as the term is used by rhetors and received by publics with different sensitivities to those meanings. What is significant about the frontier metaphor in public discourse about science is the incongruity of this rhetoric in the specific contexts of its contemporary use. When a commonplace so familiar that it is used without thought encounters unintended audiences, or purposes that conflict with its connotations, or ambiguities of public memory, the resulting rhetorical product can be strange, illogical, and unproductive. Identifying these incongruities can help us to better understand individual texts and their reception, as well as the contours of our changing language and cultures.

This book is addressed to several scholarly communities, including rhetoricians, rhetoricians of science, and other science studies scholars. Rhetoricians have studied the frontier myth in political speeches, movies, and nonfiction books, describing the way in which American politicians, filmmakers, and writers extend the space of the frontier myth, from the now civilized Western territories into a new uncivilized space: be it third-world country, outer-space, or the virtual world of new media.[3] But rhetoricians have not studied the "science is a frontier" *metaphor*, in which the myth is extended not into a new spatial location, but into a profession that metaphorically explores a *knowledge* territory. Nor have rhetoricians done much to examine the ways in which shifting audiences and historical narratives have made the frontier myth more

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[1] Patricia Nelson Limerick, "The Adventures of the Frontier in the Twentieth Century," in *The Frontier in American Culture*, ed. James R. Grossman (Berkeley: University of California Press, 1994): 94.

[2] Limerick, 68.

[3] For example, see Leroy G. Dorsey, "The Myth of War and Peace in Presidential Discourse: John Kennedy's 'New Frontier' Myth and the Peace Corps," *Southern Communication Journal* 62.1 (Fall 1996): 42-55; James L. Kauffman, *Selling Outer Space: Kennedy, the Media, and Funding for Project Apollo, 1961-1963* (Tuscaloosa: University of Alabama Press, 1994); Janice Hocker Rushing, "Mythic Evolution of 'The New Frontier' in Mass Mediated Rhetoric." *Critical Studies in Media Communication* 3 (1986): 265-96; James P. McDaniel, "Figures for New Frontiers, From Davy Crockett to Cyberspace Gurus," *Quarterly Journal of Speech* 88.1 (Feb. 2002): 91-111.

ambiguous in the current era. This work promises to extend the scholarly record on frontier rhetoric by looking at how the frontier is applied metaphorically to scientific research, and by investigating the contemporary implications of frontier language in a postcolonial transnational context. Additionally, critical approaches to the study of myth and metaphor are engaged to demonstrate how these two rhetorical concepts can be combined to reveal important qualities of texts that might otherwise go unnoticed.

Rhetoricians of science are a specialist group of rhetorical scholars who have done a great deal of work analyzing the rhetorical construction of scientific texts, but they have only recently begun to look in earnest at the public discourse of science. Studies that focus on public speeches, newspaper opinion editorials, and popular books by scientists are rare in the subfield. This book-length study of such artifacts promises to tell rhetoricians of science something about how scientists conceptualize their identity when describing their profession to others, and how such public characterizations might influence the research that they do.

While rhetoricians of science have largely studied the internal discourse of scientists, scholars who study science communication have made the public understanding of science the center of their work. Mostly housed in departments of mass communication and journalism, they have produced an extensive literature on the media frames that drive science journalists.[4] However, they have done little work on the language choices of scientists who speak directly to the public in op-ed essays, books, or speeches. My research examines this relatively unmediated public discourse of scientists on the assumption that the public perception of science is at least partially shaped by scientists, rather than merely by the (mis)representation of science writers.

There are a few other science studies scholars who have critiqued the frontier metaphor, but only as a part of their larger studies of gendered images and language in popular treatments of science.[5] No one has produced a focused analysis of the frontier metaphor as used by scientists and politicians in public address, nor has anyone traced the various implications of this usage in the specific contexts I study. An account of how rhetors unthinkingly use this language to promote the work of science and an examination of the contradictory entailments that follow should be of great interest to all who study the discourse of science, but especially to those interested in postcolonial theory and science in transnational contexts.

The final audience for this work, as with all of my work, will be scientists, who may benefit from a sustained study of their rhetorical choices and the impact of those choices.

Chapter 2: History of the Frontier of Science Metaphor.

This chapter begins with an etymological analysis of the term "frontier," drawing on different editions of American dictionaries at different points in time to trace the development of its meaning as a metaphor for the limits of knowledge. The primary dictionary definition for a frontier is "a border between two countries," but dictionaries include another definition marked as an "Americanism," a word sense that first came into use in this country. This sense of the frontier is "the developing, often uncivilized or lawless, region of a country."[6] It is this American

[4] For example, see Vasilia Christidou, Kostas Dimopoulos, and Vasilis Koulaidis, "Constructing Social Representations of Science and Technology: The Role of Metaphors in the Press and Popular Scientific Magazines," *Public Understanding of Science* 13 (2004): 347-62; Alan Petersen, "Biofantasies: Genetics and Medicine in the Print News Media," *Social Science and Medicine* 52 (2001): 1255-68.

[5] Mary Rosner and T. R. Johnson, "Telling Stories: Metaphors of the Human Genome Project." *Hypatia* 10.4 (1995): 104-129; Donna J. Haraway, *Modest_Witness@Second_Millennium.FemaleMan©_Meets_OncoMouse™* (New York: Routledge, 1997); José Van Dijck, *Imagenation: Popular Images of Genetics* (Washington Square, New York: New York University Press, 1998).

[6] *Webster's New World College Dictionary*, 4th Edition, Ed. Michael Agnes (Wiley Publishing, 2007): 569.

sense of the term that is being invoked when the frontier metaphor is used to refer to science at the limits of our understanding, science that has yet to be developed but is full of promise for the pioneering researchers who push into the unmapped territory before them. This definition of "frontier" is often explicitly identified in dictionaries as a figurative meaning of the term.[7] That this metaphor is a relatively new development in the English language is evidenced by the fact that this definition first began appearing in dictionaries in the middle of the 20th century.[8]

To understand what led to the first appearances of this metaphor in American dictionaries, this chapter engages a study of significant uses of the "frontier of science" metaphor in twentieth century American public address, treating the term as the sort of linguistic idiom or "performative tradition" that James Jasinski identifies as being the special purview of rhetorical critics.[9] This part of the chapter begins with a look at Frederick Jackson Turner's frontier thesis, an argument about the importance of the frontier to American character that had an enormous influence on our national self-conception.[10] At a time when the wilderness frontier had ceased to exist in America, Turner suggested a replacement for this proving ground in the metaphorical frontier of science, where the "test tube and the microscope" substitute for "the ax and the rifle."[11] After examining Turner's introduction of the metaphor, this chapter studies its use by Herbert Hoover in 1922, by John Dewey in the same year, and by botanist and mathematician J. Arthur Harris in 1930.[12] It then takes a close look at one of the most influential uses of the metaphor in Vannevar Bush's 1945 *Science: The Endless Frontier*, a government report that set the stage for the National Science Foundation.[13]

In examining these texts, this chapter offers a discussion of the rhetorical consequences of the use of this frontier metaphor for American science in the twentieth century. In short, a metaphor used as a motivational appeal to link a scientific career with heroic and exciting work had the consequence of transferring an American pioneering spirit, warts and all, to scientists, molding them in the image of fiercely individualistic, authority-averse archetypes of virile white masculinity – coarse, competitive, and isolated from a fearful public. The new scientific frontier promised a place for courageous risk-takers to seek their fortunes, an endless site for discoveries that could be turned to economic gain and thus ensure our material progress. A consequence of this belief that science would serve as a new frontier was a new duty for the Federal Government to fund science, and more specifically, to fund basic science over applied science, while leaving the specifics of how that money would be spent up to the scientist-explorers whose independence

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[7] For example, see *The American College Dictionary*, ed. Clarence L. Barnhart (New York: Harper & Brothers Publishers, 1951), 489; *The New Oxford American Dictionary*, eds. Elizabeth J. Jewell and Frank Abate (New York: Oxford University Press, 2001), 681; *Cambridge Dictionary of American English*, 349.

[8] The first two appearances of this figurative meaning appear in *Webster's Collegiate Dictionary, 5th Edition* (Springfield, MA: G. & C. Merriam Co., 1941), 403 and *Funk and Wagnalls New Practical Standard Dictionary of the English Language*, Britannica World Language Edition, ed. Charles Earle Funk, Vol. I (New York: Funk and Wagnalls Company, 1955), 533.

[9] James Jasinski, "Instrumentalism, Contextualism, and Interpretation in Rhetorical Criticism," in *Rhetorical Hermeneutics: Invention and Interpretation in the Age of Science*, eds. William Keith and Alan G. Gross (Albany: SUNY Press, 1997), 195-224.

[10] Ronald H. Carpenter, "Frederick Jackson Turner and the Rhetorical Impact of the Frontier Thesis," *Quarterly Journal of Speech* 63 (April 1977): 128. See also Ronald H. Carpenter, *The Eloquence of Frederick Jackson Turner* (San Marino, CA: The Huntington Library, 1983).

[11] Frederick Jackson Turner, *The Frontier in American History* (New York: Henry Holt Co, 1920), 284, 287.

[12] Herbert Hoover, *American Individualism* (Garden City, New York: Doubleday, 1922), 64; John Dewey, "The American Intellectual Frontier," *The New Republic* 30, No. 388 (May 10, 1922): 303-305; J. Arthur Harris, "Frontiers," *The Scientific Monthly* 30, no. 1 (January 1930): 19-32.

[13] Vannevar Bush, *Science: The Endless Frontier* (Washington D.C.: United States Government Printing Office, 1945).

from government control and from the oversight of a larger public was not only accepted in the context of the metaphor, but expected and justified. These appeals, functions, duties, and characteristics are not the only ways of thinking about contemporary American science, but they are the rhetorical implications of the "frontier of science" metaphor as it was developed in an American context in the first part of the 20th century.

Chapter 3: Scientific Research as Land Run: The Frontier Metaphor in Public Speeches by American Scientists

This chapter focuses on samples of contemporary American public address by scientists who use the frontier metaphor to argue for increased funding and support for science and science education. It demonstrates that even in our contemporary postcolonial era, as the modern problems of world-wide epidemics and global climate change call for international knowledge communities to work together, the "frontier of science" metaphor persists in attaching the imperialist motives of an earlier era to American science. The assumptions that accompany the frontier metaphor in these speeches match those reviewed in the previous chapter—that science is a heroically masculine endeavor, that basic science deserves to be funded over applied research, and that scientists are individuals engaged in a metaphorical land run to claim new territory for profitable development.

The texts examined in this chapter include a speech delivered by Leon Lederman, president of AAAS, in 1992; a speech by August Watanabe, president of Science and Technology at Eli Lilly, in 1996; a speech by Robert Gagosian, chemist and director of Woods Hole Oceanographic Institution, in 2004; a speech by Shirley Tilghman, the president of Princeton University and an accomplished molecular biologist, in 2006; and three speeches by Arden Bement, a professor of nuclear engineering who was NSF director, in 2005 and 2006.[14] In these texts, scientists are perceived through the terministic screen of "the frontier" as risk takers, fiercely individualistic and competitive, seeking glory for self and nation. Basic scientific research is privileged on the assumption that profitable applications will effortlessly follow the courageous forays of pioneering scientists just as resource flows naturally followed the literal frontiersmen of the American West. And international collaboration between scientists is discouraged when the frontier metaphor envisions science as a competition to plant the flag on intellectual territory, a zero-sum game in which we must win our place by pushing out others who get in our way. A counter-example to these assumptions is presented in the speech of a Chinese scientist who uses the frontier metaphor when talking to an American audience, but then appears to recognize some of its more unfortunate entailments and suggests an alternative way of thinking about our relationship to science.[15]

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[14]Leon M. Lederman, "The Advancement of Science," *Science* 256, No. 5060 (May 22, 1992): 1119-24; August M. Watanabe, "Leveraging Scientific Research for the Next American Century: The Future of Science and Technology in the Heartland," *Vital Speeches of the Day* 60, no. 1 (October 15, 1996): 12-14; Robert B. Gagosian, "An Old Idea for New Science: Discovery Means Taking Risks," *Vital Speeches of the Day* 71, no. 4 (December 1, 2004), 122-125; Shirley M. Tilghman, "Science: The Last Frontier," Feb. 28, 2006, speech presented at Sidwell Friends School. http://www.princeton.edu/president/speeches/20060228/index.xml; Arden L. Bement Jr., "Speech at the 30th Annual AAAS Forum on Science and Technology Policy," Washington D.C., April 21, 2005, http://www.aaas.org/news/releases/2005/0422bementText.shtml; Arden L Bement, Jr., "From Commitment to Engagement: How Industry Can Cultivate Competitiveness," http://www.nsf.gov/news/speeches/bement/06/alb060628_digital.jsp; Arden L. Bement Jr., "Testimony before the Senate Commerce, Science and Transportation Subcommittee on Technology, Innovation and Competitiveness," March 29, 2006, http://commerce.senate.gov/pdf/bement-032906.pdf.

[15] Choon Fong Shih, "Speech Presented at the Brown University Commencement Forum," May 24, 2008, http://www.kaust.edu.sa/about/presidents-speech-brown.aspx.

Chapter 4: The Dangers of Bioprospecting on the Frontier: The Rhetoric of E. O. Wilson's Biodiversity Appeals

I have demonstrated elsewhere that biologist E. O. Wilson used the frontier of science metaphor extensively and to detrimental effect in his sociobiologically-oriented *Consilience*.[16] So it is not surprising that this metaphor also appears in his popular discourse on the issue of biodiversity. What *is* surprising about his use of frontier language in books like *The Diversity of Life* and *The Future of Life* is the particular incongruity of the metaphor in this context, since the purpose of these books is to develop a "global land ethic" that opposes "the concept of wilderness as a frontier region waiting to be rolled back."[17] Despite Wilson's overall message that frontier lands, and the frontier forests of Amazonia in particular, require immediate protection, he describes biodiversity studies as a place of "unmined riches" that he encourages scientists to tap through "chemical prospecting," the search for new medicines and useful products in distant jungles that can work as "a potential shortcut" for companies like Merck, "a Columbus-like journey west, for those willing to acquire the essential skills."[18] Dwindling wildlands should be "mined for genetic material," he says, appealing to the American pioneer spirit: "The riches are there, fallow in the wildlands and waiting to be employed by our hands, our wit, our spirit."[19] The practice that Wilson introduces as "chemical prospecting" in 1992 gets taken up by others the following year under the title of "biodiversity prospecting," which gets shortened further over time into the term "bioprospecting."[20] This is the term Wilson uses in his 2002 renewal of the call for scientific exploitation by "industry strategists" of "Nature's pharmacopoeia."[21]

Wilson's appeal to the image of the scientist as a frontier explorer or prospector makes sense as a strategy to create excitement and urgency in an American audience for an otherwise tedious taxonomic study.[22] However, to those who own the land occupied by the organisms he would have the scientists study, it carries the baggage of imperialist exploitation. As one critic of "bioprospecting" points out, gold and silver mining in Latin America in the 16th and 17th centuries exploited the people of these lands to the point of extinction.[23] The call for a new campaign in which monied Western powers extract the wealth from other nations is not likely to be heard positively by the people of the nations being mined.

Vandana Shiva argues that this prospecting metaphor is not only inappropriate because of the history of exploitation it evokes, but also because of its fundamental assumptions. "[T]he metaphor of prospecting suggests that prior to prospecting the resources lie buried, unknown, unused, and without value. However, unlike the case with gold or oil deposits, local communities know the uses and values of biodiversity. The metaphor of bioprospecting thus hides the prior

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[16] Leah Ceccarelli, Shaping Science with Rhetoric: The Cases of Dobzhansky, Schrödinger, and Wilson (Chicago: University of Chicago Press, 2001), 129-39.

[17] Edward O. Wilson, *The Future of Life* (New York: Alfred A. Knopf, 2002), xxiii, 144.

[18] Edward O. Wilson, *The Diversity of Life* (Cambridge: Harvard UP, 1992), 281, 320, 321.

[19] Wilson, *Diversity*, 282, 310.

[20] Walter Reid et al., *Biodiversity Prospecting: Using Genetic Resources for Sustainable Development* (World Resources Institute, 1993).

[21] Wilson, *Future*, 125-8.

[22] An example of Wilson's attempt to make taxonomy exciting is found in his claim in *The Future of Life*, p. 15: "the renewal of the Linnaean enterprise is seen as high adventure."

[23] Ana Isla, "An Ecofeminist Perspective on Biopiracy in Latin America," *Signs: Journal of Women in Culture and Society* 32.2 (2007): 323-31.

uses, knowledge, and rights associated with it."[24] As a result, any well-meaning attempt to protect the interests of communities with local knowledge of plants runs up against the logic of the frontier myth, which favors protections for the individual and the investor. In short, "The bioprospecting perspective reflects the commodification and privatization paradigm, which only protects the rights of those who appropriate people's common resources and turn them into commodities."[25]

In the contemporary postcolonial context in which Wilson calls for "bioprospecting," it should come as no surprise that Brazil has passed legislation that greatly restricts scientific study in the Amazon "to protect the country's sovereignty and biodiversity" against what it sees as biopiracy.[26] Some Brazilians believe that environmentalist organizations that seek to protect biodiversity by "creating and controlling these [forest] reserves, which are full of mineral and other valuable resources," are engaged in a nefarious plot, "a new form of colonialism."[27] They fear that such groups are acting as arms of "the hegemonic powers [that] are engaged to maintain and augment their domination."[28] Such belief is not confined to the fringes of political thought. According to Brazil's leading polling organization, seventy-five percent of Brazilians think that their nation's natural riches could provoke a foreign invasion, and nearly three out of five distrust the activities of environmental groups.[29] This sentiment is most likely confirmed when people like Wilson make statements that characterize biodiversity studies as a part of a bioprospecting venture.

In addition to producing a close reading of the frontier metaphor in Wilson's biodiversity books, this chapter engages a reception study of 27 reviews of these books published in English-language newspapers and scientific journals to demonstrate how his use of frontier language resulted in different readers interpreting his meaning in opposite ways, almost always countering the presumed intent of the author. This chapter then undertakes a study of how *The Diversity of Life* and *The Future of Life*, which have been translated into Portuguese, were received in Brazilian newspapers, journals, blogs, and political debates. A look at Wilson's use of frontier language in these books and its reception by various audiences demonstrates how the grip of a powerful metaphor can undermine a scientist's argument for increased global research on biodiversity.

Chapter 5: Biocolonialism and Human Genomics Research: The Frontier Maps of Francis Collins

This chapter begins with the frontier metaphor that was used by scientist Francis Collins and others in the June 2000 White House press conference announcing the completion of the Human Genome Project.[30] President Clinton began the press conference with a comparison between the genome map that geneticists had placed before him and the map that Lewis and Clark gave to Thomas Jefferson after their expedition across the American frontier to the Pacific

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[24] Vandana Shiva, "Bioprospecting as Sophisticated Biopiracy," *Signs: Journal of Women in Culture and Society* 32.2 (2007): 309-10.

[25] Shiva, 313.

[26] Larry Rohter, "As Brazil Defends Its Bounty, Rules Ensnare Scientists," *The New York Times*, 28 August 2007, B4.

[27] Lorenzo Carrasco qtd. in Larry Rohter, "In the Amazon: Conservation or Colonialism," *The New York Times*, 26 July 2007, A4.

[28] Brazilian military intelligence report, qtd. in Rohter, "Conservation," A4.

[29] Rohter, "Conservation," A4.

[30] See my critique of the metaphor in this press conference in Leah Ceccarelli, "Neither Confusing Cacophony nor Culinary Complements: A Case Study of Mixed Metaphors for Genomic Science," *Written Communication* 21.1 (January 2004): 92-105.

ocean. Collins repeated the frontier imagery, describing science as "a voyage of exploration into the unknown" and celebrating the "awe-inspiring" realization that on their expedition, they "have caught the first glimpse of our own instruction book, previously known only to God."[31] In his speech, Collins not only configures the scientific enterprise as an adventurous journey, but imagines the human body as a wilderness territory, a shared inheritance that scientists have a manifest destiny to survey and exploit, a territory that explorers from different nations or in different research teams race to be the first to occupy and thus claim as their own. These metaphorical constructions were particularly shortsighted, insofar as some of the loudest objections to genomics research at that time had come from Native Americans scrutinizing the Human Genome Diversity Project.[32] A set of speeches that imagines genomes as common property to be explored and cataloged by government agents sent off warning bells of genetic imperialism. As Leota Lone Dog put it, "A new frontier is developing in the medical community at the expense of indigenous people," indigenous populations that "have been continually exploited in the name of progress."[33]

In an op-ed essay published five years after the White House press conference, Collins tried to correct his earlier rhetoric by offering a somewhat more nuanced application of the frontier metaphor. This opinion piece published in the *Seattle Times* participates again in the triumphalism of the frontier metaphor, as evidenced by its headline: "Exploring the frontiers of life: Northwest at forefront of pioneering effort to mine the secrets of the human genome."[34] Using the same trope as the press conference, Collins begins this essay with a positive analogy to the Lewis and Clark expedition. But he then makes an abrupt switch in his rhetoric, expressing regret that "many indigenous people were pushed aside" "when the white settlers came" to the Northwest. "We must ensure that we do not push anyone aside as *genomic* exploration proceeds," he advises. "We need to make sure that unjust actions, such as those inflicted upon the American Indians 200 years ago, are not repeated as we strive to build a new life in this rapidly expanding genomic frontier." The fact that Collins expresses an ambiguity about the frontier myth is significant, demonstrating that the meaning of the metaphor is shifting as our national history is rewritten over time. But even more significant is the fact that the essay then goes on to offer a solution that fails to match the problem that Collins describes; it argues for legislation that protects the privacy of individuals who fear their genomic information will be used against them by insurers or employers. It never mentions the difficult issue of protecting or even defining group rights when the genome of a human population is the territory that is being explored. In other words, the logic of the frontier continues to guide the scientist's value-system, even as he begins to shy away from the more obvious negative connotations of the frontier metaphor. What continues to mark the discourse is the protection of economic freedom and individualism, the commodification of nature, a disregard for the difficulties of defining group

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[31] "Remarks by the President, Prime Minister Tony Blair of England (Via Satellite), Dr. Francis Collins, Director of the National Human Genome Research Institute, and Dr. Craig Venter, President and Chief Scientific Officer, Celera Genomics Corporation, on the completion of the first survey of the entire Human Genome Project." 26 June 2000, 10:19 A. M. EDT, The East Room. The White House Office of the Press Secretary. http://www.ostp.gov/html/00628_2.html.

[32] For example, see "Declaration of the Indigenous Peoples of the Western Hemisphere Regarding the Human Genome Diversity Project." Phoenix Arizona, 19 February 1995. http://www.indians.org/welker/genome.htm.

[33] Leona Lone Dog, "Whose Genes are They? The Human Genome Diversity Project," *Journal of Health and Social Policy* 10.4 (1999): 58.

[34] Francis S. Collins, "Exploring the Frontiers of Life: Northwest at Forefront of Pioneering Effort to Mine the Secrets of the Human Genome," *The Seattle Times* 7 August 2005, E6.

rights, and a failure to question the appropriateness of always pushing the frontiers of science forward.

Chapter 6: Embryonic Stem Cell Research: Political Controversy over the Closing of a Frontier.

This chapter differs from the other case studies by focusing on how the use of the frontier of science metaphor by American scientists has been taken up by American politicians. Like the other chapters, it discovers that the root metaphor of the frontier continues to shape American science, even in the face of our growing postcolonial ambivalence with the frontier myth, and even in situations where the metaphor seems inappropriate to the purposes for which it is being used. The chapter begins with a discussion of President George W. Bush's use of the metaphor in his August 9th, 2001 speech restricting federal funding for human embryonic stem cell research. Given the subject of his speech, President Bush had an opportunity to remind Americans that our history of unchecked advance on the frontier resulted in the genocide of native peoples, a result that we now recognize as an atrocity.[35] Alternatively, he could have merely avoided the frontier of science metaphor in his speech, since his policy was designed to restrict access to that frontier. But the president did not pursue either rhetorical opportunity. Instead, his speech uncritically invokes the frontier of science metaphor, proclaiming that "the genius of science extends the horizons of what we can do," and recognizing human embryonic stem cell research as an exciting "new frontier" for American scientists.[36] To counter the triumphal American entailments of this metaphor that run against his purpose, he warrants a halt to the rapid advance of American scientists into this territory through a competing metaphor of "ethical mine fields." By describing stem cell research as "occupying the leading edge of a series of moral hazards," he opposes the metaphor of a profitable new frontier for development with that of a 20th century combat front. This rhetorical choice to use the frontier metaphor even when it goes against his interest, and to introduce a competing metaphor rather than explicitly calling the American frontier myth into question, tells us a great deal about the enduring power of the frontier myth in American political life.

American politicians on both sides of the political aisle demonstrated this power when they uncritically embraced the frontier of science metaphor in their opposition to the president's policy. Presidential candidate John Kerry used it in a speech on stem cell research a week after Ronald Reagan died from Alzheimer's disease, arguing that "We must lift the barriers that stand in the way of science and push the boundaries of medical exploration" since "America has always been a land of discovery – of distant horizons and unconquered frontiers."[37] Senate Majority Leader Bill Frist used it in a speech in 2005 that argued that human "embryonic stem cell research should be encouraged and supported… to advance the frontiers of health and medicine."[38] In such speeches, stem cell research restrictions are treated as a barrier keeping Americans from exploring a promising new frontier of science, even while researchers from

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[35] The parallel would have aligned well with the president's beliefs about embryos, which he considers a category of people with moral and legal rights that are not being recognized, just as the American Indians had moral and legal rights that were tragically overlooked.

[36] George W. Bush, "Remarks by the President on Stem Cell Research," 9 August 2001, 8:01 P.M. CDT , The Bush Ranch, Crawford, Texas. The White House Office of the Press Secretary. http://www.whitehouse.gov/news/releases/2001/08/20010809-2.html.

[37] John Kerry, "Democratic Radio Address," 12 June 2004. http://www.johnkerry.com/pressroom/speeches/spc_2004_0612.html.

[38] Bill Frist, "Majority leader's remarks, as prepared for delivery, on the Senate floor," 29 July 2005. http://www.msnbc.msn.com/id/8754913/.

other countries continue the race to explore that territory. Although some critics recognize the troubling entailments of the frontier myth, the frontier of science metaphor nevertheless continues to shape our understanding of science policy, with its prevailing themes of international competition for wealth acquisition and unrestricted forward movement.

Chapter 7: Conclusion.

The final chapter summarizes the findings of this inquiry. Limerick has argued that "the relation between the frontier and the American mind is not a simple one." [39] This book demonstrates the truth of this statement when it comes to the frontier of science metaphor. The metaphor encourages themes of national competitiveness and economic exploitation even by rhetors sensitive to the slow diffusion of historical revision; it then gets interpreted in the light of postcolonial conditions by transnational audiences. By studying these metaphorical entailments in the public discourse of scientists and politicians talking about science policy, we can come to better understand how a frontier logic catches us in its flypaper rhetorical trap, shaping the ends of scientific research in particular ways and sometimes blocking scientists from achieving those very same ends.

[39] Limerick, 68.