THE CULTURE OF PROOF:
SCIENCE, RELIGION, AND PHOTOGRAPHY IN AMERICA, 1780-1875

by

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Abstract

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The Culture of Proof traces the evolving contours of scientific and religious discourse in late-eighteenth and early-nineteenth century U.S. culture, and argues that concurrent developments in both fields of inquiry helped foster an emergent "culture of proof" in the early republic. Partly an adaptation of Enlightenment empiricism to the North-American terrain, and partly an incorporation of natural theology into religious epistemology, "the culture of proof" was predicated upon the belief that the accumulation, classification, and presentation of "natural facts" was the method best-suited to revealing truths about the universe. As the nineteenth century progressed, the "culture of proof" took on an increasingly visual cast, one which informed and conditioned the reception of the photographic camera in America.

Thomas Jefferson's efforts to catalogue the natural features of his home state in *Notes on the State of Virginia* embodied both a popularization of, and a resistance to, the truth-claims supplied by empirical science. Even as Jefferson inventoried the raw materials of his state, he acknowledged the constructed nature of classificatory systems and betrayed fears about the conclusions to which they could lead when guided by political or religious ideologies.

As the founding editor of *The American Journal of Science*, Benjamin Silliman helped summon into being a broad, nationally-based association of professional scientists. The journal provided scientific investigators with a communal space in which empirical evidence could be not only shared and evaluated, but also communicated to a non-specialist audience. The truth-claims of the emerging "culture of proof" were reinforced by evangelical Protestants such as Charles Grandison Finney, Edward Hitchcock, and Orville Dewey, who joined the scientific call for investigation of "natural facts" and claimed that such studies would demonstrate divine intention and design.

The "culture of proof" generated a need for precise documentation that the photographic camera eventually fulfilled. Scientists and theologians quickly championed the "objective" qualities of the new medium. The "culture of proof" had conditioned Americans to search for empirical evidence of divine intention in nature, and the camera seemed to provide that evidence. Photography gave Americans something to believe in just as they came to doubt belief itself.

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It is hard to count the many ways in which this dissertation has been improved by the provocative insight, extraordinary generosity, and unfailing support of the committee that advised it. I am indebted to my director, Joan Richardson, for pushing me to expand the scope of the project, for helping me weave together a wide array of discursive threads, and for providing the kind of intellectual and emotional support that any graduate student would be lucky to receive -- and I do count myself lucky. My discussions with Bill Kelly, whose astuteness knows no bounds, reshaped and inspired crucial aspects of the project. David Reynolds not only inspired me to take on a project with a large scope, but also taught me how to manage it. I'm also grateful to Geoffrey Batchen for reading sections of the manuscript, and for pushing me to take account of the latest developments in the field of visual culture.

I'm proud to have completed my degree at The CUNY Graduate Center, an institution that embodies the best aspects of public education in America. I'm happy to have found there the companionship and camaraderie of fellow students such as Mikhail Gershovich, Jim Groom, Duncan Faherty, David Humpheries, and Robert Dowling.

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My move to Philadelphia was eased by the intervention of Professors Joe Wittreich and Stuart Curran. Professor Curran arranged my appointment as a Visiting Scholar at the University of Pennsylvania, which made available to me the wonderful resources at the Van Pelt Library.

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My family has been a source of constant support. My parents, my sister, my aunts and uncles, and my in-laws have helped me at every step along the way. My parents, in particular, gave me hope when I thought that it was nowhere to be found.

My deepest thanks go to my wife, Liza Miller, who lived through this dissertation with me. Her intelligence, love, and companionship are the greatest gifts that have ever been conferred upon my life, and for that my gratefulness is boundless.

"That stable proof which man would fold,

How may it be derived from things

Subject to change and vanishings?"

— Herman Melville

Clarel: A Poem and Pilgrimage in the Holy Land (1876)

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Introduction

> "Give me the ocular proof."
>
> — William Shakespeare, *Othello* (1622)

> "Have you noticed how the world has changed? It's become this vast display of evidence, this exhibition of recorded data, this continuously running movie."
>
> — Graham Swift, *Out of This World* (1988)

At the beginning of the 1985 film *Back to the Future*, the teenaged protagonist, Marty McFly, hops into a car to escape the terrorists who have killed Doc Brown, his mentor. The car turns out to be a time machine that sends Marty back to the year 1955. As he struggles to return to the future, a new complication arises: he meets his parents as teenagers in the fifties, and interrupts their courtship. Marty knows that if he cannot repair this damage to the past, the future will be altered forever -- his parents will not marry one another, and his mother will never give birth to him.

Throughout the movie, Marty carries in his pocket a crumpled family photograph. The picture acts as a metaphysical register of his fate: when it seems as if his parents will fail to fall in love, his siblings begin to fade from the snapshot. Marty's image, too, starts to dissipate; once it disappears completely, he knows, his own life will cease. But just as Marty loses hope, his father commits an act of bravery that wins the affections of his mother. Marty feels renewed life in his veins, but it is not until he looks again at the

photograph, and sees that he and his siblings have rematerialized, that he truly knows that his life has been saved.

That death could be conflated with an erasure from the photographic view should not surprise us; photography, from its earliest moments, offered what Nathaniel Hawthorne called "an impression of permanence"[1] -- the sense that photographs not only represented the world, but also embodied and preserved its essence in profound ways. In a culture such as ours, in which images dominate our sense of reality, death comes to be figured as an absence from the photograph. If one is not visible before the camera, one might as well be dead.

How did photography come to signify so much to us? A full answer to that question might begin with a ride in Doc Brown's time machine, for the contemporary meaning of photography is inseparable from the long reception history of the medium. As Alan Trachtenberg has noted, photography aroused powerful, and sometimes contradictory, reactions upon its emergence in 1839:

> The dialectic of strange and familiar, of astonishment mingling with recognition, points to the predicament into which the medium was born, a predicament of comprehension. The problem of the name embodies a larger problem of knowledge: by what "parallel facts," in Emerson's phrase, should the process be translated and brought into our vocabulary? [2]

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[1] Nathaniel Hawthorne, *The House of the Seven Gables*, ed. Seymour L. Gross. New York: Norton, 1967; 315.

[2] Alan Trachtenberg, *Reading American Photographs* (New York: Hill and Wang, 1989); 4.

Photography posed a series of epistemological questions to its earliest viewers. How were photographs to be understood? What did they represent? And what systems of knowledge and language were best suited to describe them?

The early reaction to photography was in some ways typified by the commentator in an 1839 issue of *The Knickerbocker* who, upon viewing the first daguerreotypes in Paris, wrote that "their exquisite perfection transcends the bounds of sober belief."[3] Similar responses can be found throughout the newspaper reports announcing Daguerre's invention, but they have, at times, been described by historians as a series of *sui generis* moments -- as if the beauty and novelty of daguerreotypes as physical objects were the primary causes of wonder. Less attention has been paid to the ways in which photographic images fulfilled a range of desires that had been extant before the invention of the medium. Recent work by scholars such as Carol Armstrong, Geoffrey Batchen, Jonathan Crary, Joel Snyder, and Jennifer Tucker have helped remedy that by bringing our attention back to the complex social and cultural environment in which the medium, from its first moments, was enmeshed.[4]

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[3] "The Daguerreotype," *The Knickerbocker* (December, 1839). Reprinted in John Wood, *Secrets of the Dark Chamber: The Art of the American Daguerreotype*. Washington, D.C.: Smithsonian Institution Press, 1995; 230-232; 230.

[4] See Carol Armstrong, *Scenes in a Library: Reading the Photograph in the Book, 1843-1875*. Cambridge, Mass.: The MIT Press, 1998; Geoffrey Batchen, *Burning With Desire: The Conception of Photography*. Cambridge, Mass.: The MIT Press, 1997; Jonathan Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century*. Cambridge, Mass.: MIT Press, 1990; Joel Snyder, "Inventing Photography, 1839-1879," in Sara Grenough et al., *On the Art of Fixing a Shadow: One Hundred and Fifty Years of Photography* (Washington: National Gallery of Art, 1989), 3-38; Jennifer Tucker, *Nature Exposed: Photography as Eyewitness in Victorian Science*. Baltimore: The Johns Hopkins U.P., 2005.

In this dissertation, I seek to extend our understanding of early photography by providing a nuanced reading of the epistemological frames and cultural beliefs that conditioned the reception of photography in nineteenth-century America. I argue that the larger intellectual history of the period immediately preceding the birth of photography helped shape the rhetorical response to the new medium in ways that have not yet been fully acknowledged. Specifically, I propose that in the late-eighteenth and early-nineteenth centuries in America, a "culture of proof" emerged in the fields of natural science and evangelical religion; as part of this emerging culture, photographs were appropriated into a discursive system that identified truth with empirical visual evidence of natural phenomena. When Americans looked at early daguerreotypes, I argue, they saw them not only as pictorial representations of the visual sphere, but also as the word of God made manifest in material form.

Alan Trachtenberg has written that photography entered "the world not just as a practice of picture-making but as a word, a linguistic practice."[5] This dissertation puts that linguistic practice into context by focusing on the nonfiction writing produced by photographers and other commentators in a wide variety of sources. Examining texts such as popular periodicals, specialized photographic journals, letters, and diaries, I will trace the origins of the tropes used to describe photography in its early years. Such tropes ranged from William Henry Fox Talbot's conception of the camera as "the Pencil of Nature"[6] to Walt Whitman's description of photographers as "priests of the sun"[7] to the

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[5] Alan Trachtenberg, "Photography: The Emergence of a Keyword," in *Photography in Nineteenth-Century America*, ed. Martha A Sandweiss. New York: Harry Abrams, 1991; 17.

[6] Henry Fox Talbot, *The Pencil of Nature* [1844-46]. New York, Da Capo Press, 1969.

Reverend H. J. Morton's contention that "'truth,' so far as the representation of spiritual things was concerned, might be found in the word of God! in regard to material things, in Photography."[8] As Alan Trachtenberg has noted, the early photographic gallery was "an enshrinement of national icons analogous to that of Roman household gods" which "performed a quasi-religious function in a republican culture which had overthrown a system of deference based on social station and birth."[9] This dissertation will sketch the nature and dimensions of that "quasi-religious function" by exploring conceptions of nature, natural history, evidence, transcendence, sanctity, and proof during this period.

Because of my focus on the ways in which nineteenth-century Americans wrote about photography, and the ways in which that discourse was conditioned by earlier scientific and religious paradigms, my approach shares some similarities with that of postmodern critics who argue that photographs have no identity in themselves, but rather are constituted by the discourses and power relations that frame them.[10] This kind of semiotic reading of photography, inspired by Foucault's contention that "discourse

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[7]Ed Folsom, *Walt Whitman's Native Representation*. New York: Cambridge University Press, 1994: 105.

[8] Rev. H. J. Morton, D.D., "Photography as an Authority," *The Philadelphia Photographer*, Vol. 1, No. 12 (Dec., 1864).

[9] Trachtenberg; 43.

[10] Batchen, 5. Batchen cites the work of John Tagg, who argues that "Photography as such as no identity. Its status as a technology varies with the power relations which invest it. Its nature as a practice depends on the institutions and agents which define it and set it to work. Its function as a mode of cultural production is tied to definite conditions of existence, and its products are meaningful and legible only within the particular currencies they have. Its history has no unity. It is a flickering across a field of institutional spaces. It is this field we must study, not photography as such." John Tagg, "Evidence, Truth and Order: Photographic Records and the Growth of the State (1984), in *The Burden of Representation: Essays on Photographies and Histories*. London: MacMillan Education, 1988; 63.

constitutes its object,"[11] and put into practice by critics such as John Tagg, Alan Sekula, and Victor Burgin,[12] is in part a reaction to earlier, formalist scholarship which assigned to photography an essentialized identity and equated the history of the medium with the teleological progress of its technology. These postmodern critics, as Geoffrey Batchen points out, disdain the idea of "a photographic 'essence,'" and argue instead that "the photograph is never itself but always, *by its very nature, a tracing of something else*."[13] They speak of *photographies*, not *photography*.

But, surely, there is a middle ground between the postmodern conception of the photograph as a blank semiotic field and the formalist assumption that the medium has a unitary identity. This interdisciplinary study seeks to find that middle ground as it concentrates on the ways in which the reception of photography was shaped by the intellectual frameworks of earlier eras. One weakness of this approach is that much of the material I present will seem to have little to do with photography itself -- indeed, the reader will find little in-depth discussion of specific photographs or photographers. But in this weakness is also a strength: by inviting into my analysis the types of sources -- geological surveys, natural history texts, evangelical sermons -- that have rarely been considered in relation to photography, I hope to find new points of convergence between the fields of American Studies, the History of Religion, the History of Science, and the History of Art. Ultimately, this dissertation engages central questions about the meaning

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[11] Michel Foucault, *The Archaeology of Knowledge*. London: Tavistock, 1972; 49.

[12] See Tagg, *The Burden of Representation*; Alan Sekula, "The Body and the Archive," *October* 39 (Winter 1986), 3-84; Victor Burgin, *Thinking Photography*. London: MacMillan, 1982.

[13] Batchen, 9.

not only of photography, but also of America itself -- and of the ways in which photography became enmeshed in the dreams, desires, and beliefs of its citizens.

Chapter One, "Compass Rose," begins with a consideration of a text that is vital to an understanding of the rise of empiricism in America. Although it is most often read for the political and social views of its author, Thomas Jefferson, *Notes on the State of Virginia* offers a fascinating look at late eighteenth-century American attitudes towards the natural world. In its rage for order, its stockpiling of natural facts to combat cultural generalizations, its methodological fastidiousness, and its foundational belief in the superiority of empirical observation to abstract theory, Jefferson's book marks an important moment in the "culture of proof" that emerged in the early republic.

In *Notes*, Jefferson rooted this culture in the particularities of the American landscape by carefully documenting the natural features of his home state. Jefferson subscribed to an eminently empirical method of scientific analysis that was derived from Baconian thought: the pursuit of knowledge and truth began, for him, with the collection of natural facts. Like his philosophical forebears, Newton, Locke, and Bacon, Jefferson believed that statements could be shown to be true only insofar as they could be proven by scientific observation, experiment, and analysis. In the absence of such evidence, he believed, judgment must be withheld.

Jefferson's book is crucial to an understanding of early American science not only because it helped foster the empirical method, but also because it seemed to suggest that the practice of empirical science could serve as a model for the kind of participatory citizenship Jefferson hoped would flourish in the new nation. Even at those moments in

which empirical evidence threw his prevailing beliefs into doubt, Jefferson retained his hope that the collective endeavor of empirical science was best suited to the job of finding truth in the world.

Chapter Two, "*The American Journal of Science*: Building Cultures of Proof," looks at the ways in which the American scientific community Jefferson projected in *Notes on the State of Virginia* began to take actual shape during the first few decades of the nineteenth century. Benjamin Silliman played a central role in its development; from his professorship at Yale, he influenced an entire generation of American scientists. Silliman's most important legacy was his founding of *The American Journal of Science* in 1818. The journal helped summon into being a broad, nationally-based association of professional scientists, and provided a communal space for them to share their research with one another. Through a close reading of the contents of the journal, this chapter will examine the ways in which it placed empiricism at the center of America's emerging scientific communities. The journal, which was conceived by Silliman in explicitly national terms -- he argued in its inaugural issue that it would "furnish some rallying point, some object sufficiently interesting to be nurtured by common efforts, and thus to become the basis of an enduring, common interest" -- replicated Jefferson's project on a national scale. Silliman's strong religious views also imbued the journal, and American empiricism more generally, with a profound and sympathetic regard for the religious bearings of the natural sciences.

In Chapter Three, "'Statement, Specifications, Facts, Details:' Religion and the Culture of Proof," I explore the religious impulse to document natural facts, which arose from a series of converging changes in religious life, such as the rise of nineteenth-century secularism and the influence of Baconism. Looking at the ways in which nineteenth-century theologians responded to growing religious apathy, I examine the incorporation of scientific methodologies into popular religious practice.

The rise of evangelical religion reveals one way in which a scientific effort to catalogue the facts of the world began to influence religion. In 1830, the minister Orville Dewey summed up the new direction of evangelist preaching when he wrote that "it is not enough to say, in the general, that God is wise, good, and merciful....We want statement, specifications, facts, details, that will illustrate the wonderful perfections of the infinite Creator."[14] Dewey's statement could be considered the paradigmatic expression of the natural theology movement, which played an important role in spurring religious leaders to channel their energies towards scientific practice. Like other evangelical leaders, Charles Grandison Finney relied on arguments that William Paley advanced in *Natural Theology* (1802) as he urged his followers to "go out into every department of science, to find the proofs of *design*, and in this way to learn the existence of God."[15] With its focus on the gathering of facts and observations, and its antagonism towards deductive and theoretical hypothesizing, natural theology was a welcome trend for religious leaders who believed that the accumulation of natural facts would demonstrate the beauty of God's design for the universe. Even the style of evangelical preaching

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[14] Quoted in Paul Jerome Croce, *Science and Religion in the Era of William James*. Chapel Hill: The University of North Carolina Press, 1995; 15.

[15] Quoted in Croce, 56.

accrued an empiricist tone as ministers placed new emphasis on the visual demonstration of grace.

This chapter closes with an analysis of Ralph Waldo Emerson's concept of the transparent eyeball in *Nature* (1836). Emerson's notion of transparency provided a provocative model for the vision of the photographic camera. Just as Emerson's transcendent moment heralded a melding of metaphysical substances in which all possible errors of vision -- all defects in the human eye, all biases that could affect the mind that interpreted the images passing through it -- were wiped clean, so the camera seemed to erase itself as it enabled humans to interact with the world at an elemental level, providing the kind of original connection to the universe that Emerson craved.

Chapter Four, "Transcendent Impressions: The Camera as the Eye of God," examines the entrance of photography into the culture of proof. Tracing the many religious concepts used in the discourse around photography in its early years, this chapter suggests that when Americans looked at daguerreotypes, they reacted to them not just as pictorial objects, but also as pieces of empirical proof at a time when many trusted sources of proof had become compromised. As the church began to play a diminished role in the everyday lives of Americans -- and as the sense of reassurance that the Church had provided began to dissipate -- daguerreotypes offered hope of metaphysical stability. Just as biblical criticism and geological science had begun to cast doubts upon the reliability of the Bible, daguerreotypes seemed to supply proof that the universe had indeed been designed by a higher power. Americans reacted so strongly to photography not only because the pictures themselves were so beautiful or because the picture-making

technology was so new, but also because earlier scientific and religious discourse photographs had encouraged them to search for empirical evidence of divine intention in nature.

This chapter also explores two mid-nineteenth century scientific works, Edward Hitchcock's *The Religion of Geology* (1852) and Balfour Stewart and P.G. Tait's *The Unseen Universe* (1875), which turned to the subject of photography in order to reconcile modern science with traditional religious doctrines. As a technology that exemplified the new spirit of scientific innovation, but that was interpreted, from its earliest days, within a discourse of spiritual belief, photography was perfectly suited to mediate the growing divide between religion and science. It should come as no surprise, then, that two books which presented new theories of the universe positioned photography as the basis for new models of the innermost workings of the cosmos. Each book found, in photography, a suggestive figure for a diverse set of phenomena, such as the interaction of heavenly objects, the relationship between God and humankind, and the nature of visible and invisible elements of the world. These works offer fascinating examples of the ways in which photography became a tool of the materialist urge to present visual evidence in the "culture of proof."

A detailed examination of the influence of scientific and religious discourse on the American reception of photography is long overdue, and a deeper awareness of the culture in which photography evolved will enrich our understanding of the medium as a whole. More importantly, it will enable us to trace the changing nature of fact, belief,

and perception in nineteenth-century American life for which photography provided the perfect epistemological analogue.

Chapter 1

Compass Rose

"A patient pursuit of facts, and cautious combination and comparison of them, is the drudgery to which man is subjected by his Maker, if he wishes to attain sure knowledge."

— Thomas Jefferson, *Notes on the State of Virginia* (1787)

"Black jack oak. Quercus aquatica. Clayton. Query?

Ground oak. Quercus pumila. Clayton.

Live oak. Quercus Virginiana. Millar.

Black Birch. Betula nigra.

White birch. Betual alba.

Beach. Fagus sylvatica.

Ash. Fraxinus Americana.

Fraxinus Novæ Angliæ. Millar.

Elm. Ulmus Americana.

Willow. Salix. Query species? <Fluvialis. Bartr. 393>"

—Thomas Jefferson, *Notes on the State of Virginia* (1787)

"Thus, in the beginning, all the world was America"

— John Locke, *Two Treatises on Government* (1690)

One year after Thomas Jefferson became Governor of Virginia, an unidentified Hessian officer visited the tribute to Enlightenment rationalism that Jefferson had named Monticello. The officer recorded his impressions of the 1780 visit, and a Hamburg newspaper published the account. Struck by the way that Jefferson had incorporated scientific knowledge and principles into the structure of his residence, the officer wrote:

> The Governor possesses a Noble Spirit in Building. He is now finishing an elegant building projected according to his own fancy. In his parlour he is creating on the Cieling [sic] a Compass of his own invention by wich [sic] he can know the Strength as well as the Direction of the Winds. I have promised to paint the Compass for it.[16]

Jefferson's home was filled with scientific inventions, which ranged from an astronomical clock to a polygraph machine to a self-designed heating and cooling system. As one biographer has noted, "there were so many gadgets and contrivances in Monticello that it was an inventor's paradise."

And yet, despite the plethora of scientific instruments, books, and tools that filled the halls of Monticello, it was the humble compass rose that best exemplified Jefferson's attitude towards the natural world. Connected to a weather vane on the East Portico of the mansion by a shaft that extended down through the ceiling below, the compass rose allowed Jefferson to measure the direction of the wind without leaving his home. Even

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[16] Quoted in Silvio A. Bedini, *Thomas Jefferson: Statesman of Science*. New York: MacMillan Publishing Company, 1990; 82.

when he was inside, then, Jefferson remained connected to the exterior environment; but rather than providing a direct connection to the elements, as an open window might have allowed him to feel a cold breeze on his skin, the compass rose interposed the machinery of scientific analysis between Jefferson and nature. It put him in an attitude of constant measurement and scrutiny, a mode of constant survey, an approach to the world that had, as its basic premise, the notion that it was possible to discern order in the universe through the accumulation of data and the classification of natural facts.

For a modern reader seeking to understand early American attitudes towards the natural world, Jefferson's *Notes on the State of Virginia* provides a provocative compass rose of its own. In its rage for order, its stockpiling of natural facts to combat cultural generalizations, its methodological fastidiousness, and its foundational belief in the superiority of empirical observation to abstract theory, Jefferson's book marks an important moment in what I call the emerging 'culture of proof" in the early republic. This culture was founded upon a heightened awareness of evidentiary proof as the basis for successful argumentation, and posed, as its methodology for discerning truth in the world, a strong emphasis on the documentation of natural facts -- those pieces of observable evidence whose existence could be confirmed by multiple observers. As a lengthy compilation of evidence by a man who relied on his powers of observation, Jefferson's book was a primary node of the culture of proof.

And yet, at key moments in his text, Jefferson displayed an uneasy resistance to that same evidence, a fear of the destinations to which it could lead when guided by political or religious ideology. Even as Jefferson relied on empirical data throughout the book, he sought, at times, to deflect attention away from it when it led to conclusions

with which he disagreed. *Notes on the State of Virginia*, then, demonstrates both the promise of empiricism in America as well as the tensions surrounding its ascendance.

Bodies of Evidence

As Jefferson noted in a small advertisement for *Notes the State of Virginia,* his only published book was written "in answer to Queries proposed to the Author by a Foreigner of Distinction, then residing among us."[17] In 1780, the secretary of the French delegation in Philadelphia, the Marquis de Barbé-Marbois, had sent questionnaires to leading men in every state in order to ascertain the natural, cultural, political, and economic dimensions of the nascent American nation. Most of the responses Marbois received were unremarkable -- John Sullivan of New Hampshire, for example, replied with only brief answers.[18] In Virginia, Marbois had sent his query to the Congressman Joseph Jones; Jones passed it on to Jefferson, who was at that time the Governor of the state. Unable to respond immediately, Jefferson began to work on his manuscript the following year during a temporary withdrawal from political life.[19] Marbois' questions

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[17] Thomas Jefferson, *Notes on the State of Virginia,* ed. William Peden. Chapel Hill: The University of North Carolina Press, 1954; 2. Further citations will appear in the text.

[18] Brooke Hindle, *The Pursuit of Science in Revolutionary America, 1735-1789*. Chapel Hill: The University of North Carolina Press, 1956; 320.

[19] Jefferson was forced to resign the Governorship under the threat of public censure by his political foes. Although he was later exonerated, the incident bothered the thirty-eight year-old Jefferson deeply. He lamented that the experience "was a shock on which I had not calculated," one that "inflicted a wound on my spirit which will only be cured by the

spurred him to conduct a thorough examination of his home state, and to compose a work that has come to be regarded as one of the classics of the period.[20] As one scholar has noted, he was "not one to make short work of an interesting problem."[21]

The interesting problem that Jefferson found before him was, in effect, the task of accounting for and explaining to a foreign audience a state that claimed lands amounting to almost a third of the national territory.[22] Growing like the fruits and vegetables he tracked, Jefferson's project evolved from a loosely knit set of responses to a coherent

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all-healing grave." TJ to James Monroe, 20 May 1782, *Thomas Jefferson: Writings*, ed. Merrill D. Peterson. New York: Library of America, 1984, 778.

[20] Jefferson's book has come under increasing scrutiny in recent years, particularly by critics interested in the nexus of exploration, natural history, and empire. For further reading on this subject, see Kris Fresonke, *West of Emerson: The Design of Manifest Destiny* (Berkeley: University of California Press, 2003); Myra Jehlen, "The Literature of Colonization" in *Cambridge History of American Literature*, ed. Sacvan Bercovitch (Cambridge, Eng.: Cambridge University Press, 1994) and *American Incarnation: The Individual, the Nation, and the Continent* (Cambridge: Harvard University Press, 1986); Mary Louise Pratt, *Imperial Eyes: Travel Writing and Transculturation* (London: Routledge, 1992); and Pamela Regis, *Describing Early America: Bartram, Crèvecoeur, and the Rhetoric of Natural History* (DeKalb: Northern Illinois University Press, 1992). Helpful articles include Robert A. Ferguson, "'Mysterious Obligation': Jefferson's *Notes on the State of Virginia*," *American Literature* Vol. 52, No. 3 (Nov., 1980): 381-406; Matthew Cordova Frankel, "'Nature's Nation Revisited': Citizenship and the Sublime in Thomas Jefferson's *Notes on the State of Virginia*," *American Literature* 73.4 (2001): 695-726; Christopher Looby, "The Constitution of Nature: Taxonomy as Politics in Jefferson, Peale, and Bartram," *Early American Literature* 22.3 (1987): 252-273; and Elisa New, "Beyond the Romance Theory of American Vision: Beauty and the Qualified Will in Edwards, Jefferson, and Audobon." *American Literary History* 7.3 (Autumn, 1995): 381-414. For an important earlier study of the work, see Leo Marx, *The Machine in the Garden: Technology and the Pastoral Ideal in America* (New York: Oxford University Press, 1964).

[21] Frank Shuffelton, "Introduction," in Thomas Jefferson, *Notes on the State of Virginia*. New York: Penguin, 1999; x.

[22] Larzer Ziff, *Writing in the New Nation: Prose, Print, and Politics in the Early United States*. New Haven: Yale University Press, 1991; 132.

book-length manuscript. Empirical science played a crucial role in the text, for it allowed Jefferson to catalogue and display the production of the state for his French audience.

It has been a much remarked upon fact that Jefferson rearranged Marbois' queries so that his responses progressed neatly from nature to culture (from "Boundaries of Virginia" to "Productions mineral, vegetable and animal" to "Constitution" to "Histories, memorials, and state-papers").[23] Whether or not one reads a philosophical progression into the organization of Jefferson's answers, it is the act of ordering itself that performs the "cultural work" of the book.[24] Categorization and classification were of paramount importance to Jefferson and were part of the legacy he received from his reading of Enlightenment philosophy and science. Jefferson believed, as Kris Fresonke has written, that "continents [could] be brought to order with an inventory of their contents"; it was his faith in the order that could be achieved through exploration that led him, in 1803, to deliver a secret message to Congress requesting funds to send Meriwether Lewis and

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[23] Susan Manning makes this point in "Naming of Parts; or, The Comforts of Classification: Thomas Jefferson's Construction of America as Fact and Myth," in *Journal of American Studies*, 30 (1996): 345-64; 348. In his introduction *Notes on the State of Virginia*, Frank Shuffleton cautions against "seeing the reordering of the queries as simply ideological." Elsewhere he points out that "Jefferson's imaginative progress through *Notes on the State of Virginia* was dialectic rather than linear, playing over the complexity of his subjects in order to tease out a variety of meanings and possibilities of life in Virginia." Shuffleton, xx-xxi. Leo Marx has argued that "the sequence embodies the 'Lockean' presuppositions...about the relations between nature, man, and society." Marx, 119.

[24] I borrow the term "cultural work" from Jane Tompkins's *Sensational Designs: The Cultural Work of American Fiction, 1790-1860* (New York: Oxford University Press, 1985). Tompkins argues that the cultural work of a text involves its engagement "in solving a problem or set of problems specific to the time in which it was written, and that therefore the way to identify its purposes is not to compare it to other examples of the genre, but to relate it to the historical circumstances and the contemporary cultural discourse to which it seems most closely linked" (38).

William Clark in search of the Northwest Passage. It was also what led him to outline a system of knowledge in the complex bibliographical charts that he created for the 6700 volumes he sold to the federal government following the British destruction of the national library during the War of 1812.[25] Jefferson, who acknowledged the arbitrary nature of taxonomic systems, understood that acts of classification had ramifications more significant than the shuffling of Latinate names in statistical tables. Like maps, taxonomies were assertions of power and control. They reflected the order that their authors believed to be latent in nature, but they also created order in the social world, and the meanings that they generated were often tied to personal, political, and economic agendas. This aspect of the project must have appealed to Jefferson, who wrote his manuscript only a year after the British invasion of Tidewater, Virginia. As he compiled his register of the state, Jefferson laid claim to its productiveness as he sought to repel the acquisitive desires of the British empire and to encourage French investment in America.

Many critics have pointed to Jefferson's profuse catalogues of the animals, minerals, and plants of Virginia as one of the major difficulties of reading *Notes on the State of Virginia*. Leo Marx wrote that upon first encounter, Jefferson's book "looks like a cross between a geography textbook and a statistical abstract."[26] While the impulse to quantify and catalogue was an essential feature of Jefferson's thought, he deployed long lists in *Notes on Virginia* with a specific purpose in mind: much of the scientific detail was meant to counter the claims of the Abbé Raynal. Raynal was a follower of the respected naturalist George Louis Leclerc, the Comte de Buffon, who directed the

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[25] Manning, 360.

[26] Marx, 118.

Parisian Jardin du Roi and published the magisterial, forty-four volume *Histoire Naturelle, Gènèrale et Particuliére* between 1749 and 1788. In the *Histoire,* Buffon advanced the theory of "degeneration" in America, which held that plant and animal species of the New World were smaller and weaker than their European counterparts, primarily because of the cold and moist climate of the New World..[27] Raynal extended Buffon's theory to the human realm as he argued that Native Americans were feeble and naive compared to the Europeans who had subjugated them upon arriving in the New World. Raynal's broadside emerged from a point of sympathy with oppressed populations -- he was outraged by the American practice of slavery -- but his deprecations offended Americans such as Jefferson and Ben Franklin.[28] Although Jefferson named Buffon more often in the text of *Notes on the State of Virginia*, Raynal was the true target of his broadside.

In order to disprove the disparaging generalizations of Raynal and Buffon, some of Jefferson's statistics-laden tables demonstrated the range and diversity of the flora, vegetables, animals, and minerals of Virginia, while others listed the exact sizes of animals in the Old and New Worlds. The catalogues highlighted Jefferson's scientific precision and zeal for order; in one entry on his list of American and European animals, for instance, he measured out to three decimal places the weight of the Virginian Fox Squirrel. The power and thrust of *Notes on the State of Virginia* relies on this kind of rigorous presentation of empirical evidence. Even as he disputed French theories,

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[27] I. Bernard Cohen, *Science and the Founding Fathers: Science in the Political Thought of Jefferson, Franklin, Adams, and Madison*. New York: W.W. Norton, 1995; 74.

[28] David Waldstreicher, "Introduction," in Thomas Jefferson, *Notes on the State of Virginia*. New York: Bedford/St. Martin's Press, 2002; 1-2.

however, Jefferson claimed only that his tables were meant "to justify a suspension of opinion until we are better informed, and a suspicion in the mean time that there is no uniform difference" between the size of American and British animals (49). Jefferson had expressed a similar qualification earlier in the passage, when he stated that "we are not furnished with observations sufficient to decide this question" (48). Jefferson's claim that it was too early to draw definitive conclusions from the observable evidence indicated a gentlemanly reluctance to criticize a respected authority such as Buffon, even as his data forced him to do so. While refuting some of Buffon's theories, Jefferson attempted to assuage his criticisms by noting that "I think him the best informed of any Naturalist who has ever written" (56). He also wrote of Buffon's text that "the wonder is, not that there is yet something in this great work to correct, but that there is so little" (55). And yet, the numbers Jefferson placed in his tables made Buffon's errors difficult to overlook.

Nevertheless, contrary to Merrill Peterson's claim that "Jefferson's vindication of American nature attacked the Buffon theory in its conclusions rather than its premises,"[29] Jefferson's catalogues highlighted the fundamental lack of empirical evidence in Buffon's hypothesis. By contrasting the scientific processes of Buffon and Raynal with his own meticulous examinations of observable phenomena, Jefferson demonstrated the need for further empirical surveys of the American landscape. As he wrote later in the same passage, "Nature has hidden from us her modus agendi. Our only appeal on such questions is to experience; and I think that experience is against the supposition" (48). Studies such as Buffon's and Raynal's that were not supported by empirical claims, he

[29] Merrill D. Peterson, *Thomas Jefferson and the New Nation*. New York: Oxford University Press, 1970: 253.

implied, depended on an unlikely knowledge of divine intention. Jefferson emphasized the importance of natural evidence in the pursuit of science when, in 1787, he imported the bones and skin of an American moose to France. Jefferson had it stuffed and delivered to Buffon's home in order to present concrete proof that American animals bore little resemblance to the diminutive creatures that the French naturalist had described.

Jefferson's deployment of natural facts in *Notes on the State of Virginia* marks an important moment in the development of the culture of proof in America. It was not, of course, the first American book to gather evidence from nature. But in its central assertion that natural facts were beyond refutation, and in its use of such facts to construct an empirical portrait of the nascent nation, *Notes on the State of Virginia* sounded a key note of self-definition for the country that rivaled, in some ways, the author's 1776 Declaration. The revolution it engendered in American culture was no less extraordinary, though it was considerably more subtle.

Jefferson's answer to Query VI ("Productions Mineral, Vegetable and Animal") contained information not only on the natural resources named in its title, but also on American Indians and African-Americans. Although the act of grouping of humans with quadrupeds, vegetables, and "brute animals" might seem indicative of Jefferson's racial biases, Jefferson discussed human races in this query in response to the Abbé Raynal. As noted earlier, Raynal had extended to human beings Buffon's theory of degeneracy of animals and plants in the New World. In response, Jefferson attempted to prove that such theories had no foundation in fact. He quoted a long passage in which Buffon disparaged the sexual vigor of Native Americans. Buffon wrote that the American "savage is feeble,

and has small organs of generation; he has neither hair nor beard, and no ardor whatever for his female" (59). In response, Jefferson argued that, based on his experiences, the Native American man "is neither more defective in ardor, nor more impotent with his female, than the white reduced to the same diet and exercise" (59). Jefferson approached the issue through a kind of comparative anthropology:

> It is civilization alone which replaces women in the enjoyment of their natural equality. That first teaches us to subdue the selfish passions, and to respect those rights in others which we value in ourselves. Were we in equal barbarism, our females would be equal drudges. (60)

Although Jefferson clearly presented Native Americans as primitives, he compliments their intelligence and morality. Citing the stirring speech and actions of Chief Logan, a chief of the Mingo people, he argued that Native Americans possessed both honor and eloquence; once their culture had advanced progressed upon the road to European enlightenment, he suggested, Native Americans will be capable of the equal achievements. They represented, he proposed, a primitive version of American genius.

And yet, as David Waldstreicher points out, Jefferson's forward-thinking respect for Native American culture was compromised, in the end, by his acquisitive desires. Even as Jefferson explained Native American culture to his French audience, he claimed that culture as material for American science and justified the taking of Indian lands by white men:

> [Jefferson's] willingness to admit of genius in Native Americans provides evidence of Jefferson's lack of hatred for Indians to his European readers, even while his listing of their traits reinforces their status as a separate species, or race, and one that is disappearing fast (not unlike the mammoth). Their bones, too, are subjects of American science and can be claimed by Jefferson to give the land history, its proof of antiquity, a noble heritage. Such stories end with praise of Indian oratory -- a cultural artifact that can be preserved, in print -- and with Jefferson himself as the collector of Native American words, bones, and things; the teller of their tragic tale; and the keeper of the American museum.[30]

Jefferson's championing of Indian culture, then, demonstrates some of the darker subtexts of the empirical method, specifically, and the culture of proof, more generally. Lurking behind the urge to gather natural facts were the accompanying urges to own and display. Such desires seemed harmless when naturalists gathered leaves, vegetables, and flowers; but when they began to transform human bodies and religious relics into material for museum exhibitions, they ventured into questionable ethical territory.

This tendency towards collection -- which was often paired with an element of dehumanization of its subjects -- is apparent in other places in the text. Just as Hector St. John de Crevecoeur had suggested that "Men are like plants," Jefferson attempted to extend his classificatory zeal to the human realm. His proto-scientific descriptions of black slaves form some of the most troubling passages of *Notes on the State of Virginia*.

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[30] Waldstreicher, 27.

Writing about enslaved African-Americans with the cold eye of a naturalist inspecting a new species of plant, Jefferson explained that "they secrete less by the kidnies, and more by the glands of the skin, which gives them a very strong and disagreeable odor" (139). Noting that "the first difference which strikes us is that of colour," Jefferson wondered whether "the black of the negro resides in the reticular membrane between the skin and scarf-skin, or in the scarf-skin itself; whether it proceeds from the colour of the blood, the colour of the bile, or from that of some other secretion" (138). Reduced to a scientific curiosity, blackness joined the ranks of natural phenomena that had to be observed and studied in order to be understood. Jefferson brought such an approach into sharper relief later in the same query, when he envisioned the placement of black bodies under the anatomical knife. Reaching a general conclusion about the minds of black people, he wrote, "requires many observations, even where the subject may be submitted to the Anatomical knife, to Optical glasses, to analysis by fire, or by solvents" (143). This vision of dissection, burning, and dissolution in pursuit of knowledge did not seem to faze Jefferson, even as he argued elsewhere for the dignity of slaves and for the need to emancipate them.

Similarly, Jefferson's account of his exploration into the Indian burial mounds in Query XI marked a disturbing extension of empiricist science into the human sphere. In an effort to investigate the burial customs of an Indian tribe in his neighborhood, Jefferson decided to explore a burial mound near his home. Describing its dimensions in flatly objective terms similar to those he would use to delineate the dimensions of the Natural Bridge, Jefferson wrote that the mound was "of a spheroidical form, of about 40 feet diameter at the base, and had been of about twelve feet altitude" (98). When a skull

that he picked up inside the mound "fell to pieces on being taken out," Jefferson remarked only that this "prevented[ed] satisfactory examination" (99); in the guise of the disinterested scientist, he seemed oblivious to the fact that he had desecrated a sacred burial site. He suggested that the experience was useful because it had yielded "the most decisive proof of the burial of children here" (99). This passage, along with Jefferson's proposed dissection of black slaves, shows that the light of Enlightenment science could belie a substantial moral darkness. But it also shows the degree to which empirical proof and evidence had become prized by the larger culture, and the lengths to which Americans would go in order to find it.

It is clear that Jefferson's attitude towards Native Americans and black slaves were widely divergent. In *Notes on the State of Virginia*, Native Americans appear as noble savages, primitive people who have not yet attained enlightened culture, but who seem capable of developing it. Black slaves, however, appear as subhuman beings, handicapped by nature with inferior minds and bodies. Jefferson's treatment of African-Americans was particularly odious in Query XIV; the passages cited above, wherein Jefferson proposes the dissection of black bodies in order to locate blackness in the skin, are accompanied by other sleights. As a solution to the problem of slavery, which he had termed a "great political and moral evil" (87) earlier in the text, Jefferson suggested that slaves should be sent to another country. This separation was necessary not only because of the "deep rooted prejudices entertained by the whites" (138), which would prevent black people from being full citizens of the state, but also because of some "physical and moral" ones. Jefferson compared the desires of black people to those of "Oran-ootans," and argued that "they seem to require less sleep . . . they are more ardent after their

female: but love seems with them to be more an eager desire, than a tender delicate mixture of sentiment and sensation" (139). Enumerating a series of similar observations, Jefferson ends up transferring Raynal's slurs against Native Americans to black slaves. He writes, furthermore, that these differences are "fixed in nature, and [are] as real as if [their] seat and cause were better known to us" (138).

Why does Jefferson argue for nurture in the case of Native Americans, and nature in the case of African Americans? The answer, it seems, has to do with his audience. Jefferson wrote his book for the French, and did not expect it to be published widely. Buoyed by the French support of the American colonies in the War of Independence, he hoped to interest them in trading with America.[31] But he also knew that slavery posed a moral problem for many Europeans; and so, his representations of Native American subjects catered to the European stereotype of the noble savage, while his representations of African American subjects attempted to make slavery understandable to an anti-slavery audience. If black people were inferior by nature, by this logic, then the oppressive practices of the Virginians who enslaved them could be excused, or, at the very least, understood. Jefferson hoped that by arguing that "the blacks, whether originally a distinct race, or made distinct by time and circumstances, are inferior to the whites in the endowments of body and mind," his French audience would take a more sympathetic view of American slavery, which was considered vital to the agricultural economy of the state. But these passages show Jefferson at his most perplexing as he navigates between his own conflicted beliefs and those of his European audience.

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[31] Waldstreicher, 17.

Logic and Evidence: The Philosophical Basis of the Culture of Proof

Just as Jefferson relied on Enlightenment philosophy when he wrote the Declaration of Independence, he fulfilled the Enlightenment call to study nature as he regarded the compass rose from the comfort of his parlor. He subscribed to an eminently empirical method of scientific analysis: the pursuit of knowledge and truth began, for him, with the collection of natural facts. Like his philosophical forebears, Newton, Locke, and Bacon, Jefferson believed that statements could be shown to be true only insofar as they could be proven by scientific observation, experiment, and analysis. This philosophical context served as the bedrock for the entire culture of proof that emerged on the American stage in the late eighteenth and early-nineteenth centuries.

One of the central philosophical debates of the Enlightenment centered upon questions of which methods of argumentation were best suited to prove or disprove the truth of an idea. Before the seventeenth century, such epistemological disputes took place within the deeply traditional methodology of Aristotelian logic. This logic was deductive in nature, and depended upon the use of syllogisms: a new idea could be proven true only when it had been demonstrated to be consistent with previously accepted maxims. Such syllogistic reasoning depended on what was called the "*dictum de omni et nullo.*" In the words of the eighteenth-century logician William Duncan, the *dictum* meant that "whatever may be affirmed [or denied] universally of any Idea, may be affirmed [or denied] of every or any Number of Particulars comprehended under that

Idea."[32] All syllogistic reasoning, in other words, deduced information about particular truths from previously established general truths.

Aristotelian logic held sway until Enlightenment critics began to point out weaknesses in the system. In *An Essay Concerning Human Understanding* (1690), John Locke argued that while Aristotelian methods exercised the mind in intellectual debates, they were of little help in judging the veracity of ideas. Syllogistic reasoning, he wrote, was "more proper for the attaining Victory in dispute, than for the Discovery or Confirmation of Truth, in fair Enquiries."[33] Syllogisms constituted, at best, "the Art of fencing with the little Knowledge we have, without making any Addition to it."[34] Locke pointed out that the dependence on accepted maxims chained human knowledge to the errors of the past, sometimes in obvious contradiction to new evidence available to the eye. Aristotelian logic, therefore, discouraged fresh ideas, new perspectives, and novel scientific discoveries. In addition, as the historian Wilbur Samuel Howell has noted, Locke felt that the use of maxims in teaching led to a "false sense of values in respect to scientific enquiry," whereby "truth appear[ed] to issue from maxims rather than from the facts of experience."[35] Locke argued that this led to a system of education in which observable evidence was denigrated as "merely probable knowledge."[36]

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[32] William Duncan, *Posthumous Works of Mr. John Locke* (London, 1706): 137. Quoted in Wilbur Samuel Howell, "The Declaration of Independence and Eighteenth-Century Logic," *William and Mary Quarterly* 18 (1961): 463-84; 476-77.

[33] John Locke, *An Essay Concerning Human Understanding*, ed. Peter H. Nidditch. Oxford: Oxford University Press, 1975; IV.vii,. 677-78.

[34] Locke, IV.xvii, 679.

[35] Locke wrote: "The Schools having made Disputation the Touchstone of Mens Abilities, and the Criterion of Knowledge, adjudg'd Victory to him that kept the Field:

Locke's objections to this system of education, and to the Aristotelian logic upon which it was based, were grounded in the empiricist science of Francis Bacon. Bacon had written in *Novum Organum* (1620) that "the syllogism consists of propositions, propositions consist of words, words are symbols of notions. Therefore if the notions themselves . . . are confused and over-hastily abstracted from the facts, there can be no firmness in the superstructure. Our only hope therefore lies in a true induction."[37] Bacon expanded upon the problems inherent in syllogistic logic by comparing its method with his own inductive process:

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and he that had the last Word was concluded to have the better of the Argument, if not the Cause....To prevent, as much as could be, the running out of Disputes into an endless train of Syllogisms, certain general Propositions, most of them indeed very self-evident, were introduced into the Schools, which being such as all Men allowed and agreed in, were look'd on as general Measures of Truth, and serv'd instead of Principles, (where the Disputants had not laid down any other between them) beyond which there was no going, and which must not be receded from by either side. And thus these *Maxims* getting the name of *Principles*, beyond which Men in dispute could not retreat, were by mistake taken to be the Originals and Sources, from whence all Knowledge began, and the Foundations whereon the Sciences were built. Because when in their Disputes they came to any of these, they stopped there, and went no farther, the Matter was determined. But how much this is a mistake hath been already shewn." Locke, IV.vii,, 600.

[36] Wilbur Samuel Howell, *Eighteenth-Century British Logic and Rhetoric*. Princeton: Princeton U.P., 1971; 282. Even Locke's attempts to state the positive aspects of syllogisms were veiled attacks—he wrote that "as far as they are advanced," they could be of use in teaching the Sciences (the negative implication being that they would not be useful for teaching future sciences); they were useful in disuputes "for the silencing of obstinate Wranglers, and bringing those Contests to some Conclusion" (the negative implication being that they would otherwise never reach a conclusion). Locke; IV.xvii, 600.

[37] Francis Bacon, *Novum organum sive indica de interpretatione naturae*, aphorism 14, cited in Karl R. Wallace, *Francis Bacon on Communication & Rhetoric; or: The Art of Applying Reason to Imagination for the Better Moving of the Will*. Chapel Hill: University of North Carolina Press, 1943; 94.

> There are and can be only two ways of searching into and discovering truth. The one flies from the senses and particulars to the most general axioms, and from these principles, the truth of which it takes for settled and immovable, proceeds to judgment and to the discovery of middle axioms. And this way is now in fashion. The other derives axioms from the senses and particulars, rising by a gradual and unbroken ascent, so that it arrives at the most general axioms last of all. This is the true way, but as yet untried.[38]

The influence of the inductive method, which Bacon considered "the true way," grew in the centuries that followed. Bacon himself is often referred to as the founder of modern science, for, along with Newton and Robert Boyle, his emphasis on observation and experiment opened epistemological enquiries to the methodology of science. Yet Bacon's method, which he called "true induction," was not as simple as it seemed; in fact, at crucial steps, it called for a deductive process. As Michael Malherbe has written, the inductive method was, for Bacon, a sort of "conceptual plot," simple in theory, but complex in function:

> [For Bacon,] knowledge starts from sensible experience, rests upon natural history which presents sense data in an ordinate distribution, rises up from lower axioms or propositions to more general ones, tries to reach the more

[38] Francis Bacon, *Novum organum*, cited in Michel Malherbe, "Bacon's Method of Science," in *The Cambridge Companion to Bacon*, ed. Markku Peltonen. New York: Cambridge University Press, 1996: 75-98; 79.

> fundamental laws of nature (the knowledge of forms) and, from there, by a practical deduction, derives new experiments or works.[39]

Bacon's inductive method, in other words, was not simply a directly empirical process by which sensory data about particular natural facts led to general theories about the natural world, but rather was a complex process that began with the collection of empirical data and proceeded, step-by-step, through a series of abstracting inferences that led towards more general truths about the universe. Once those general truths had been established by induction, a "practical deduction" led to the formation of new enquiries. Instead of beginning with a set of accepted maxims, then, the Baconian scientist made careful observations of the natural world and drew only those conclusions that could be supported by the compiled data. In this way, generalized facts could be established only when an accumulation of particular facts had been systematically studied and methodically abstracted. As Malherbe notes, "although it is the case [for Bacon] that all true science depends on the senses, we should not forget that their information must be corrected and enlarged. Method penetrates sensible experience itself, and stipulates the conditions according to which the senses can judge of the reality of things."[40] As the eighteenth-century French natural historians and classificationists who followed Bacon understood, the accumulation of natural facts was a necessary first step towards truth, but it had to be followed by the proper arrangement of new information through the use of a carefully calibrated scientific method and a sufficiently complex system of order.

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[39] Malherbe, 76.

[40] Malherbe, 83.

Doubting the Evidence: A Shell Game?

Even as the bulk of Jefferson's text demonstrated the strength of empirical methodologies, Jefferson's stance towards empirical knowledge was complicated by several passages in the book. In these passages, Jefferson turned away from the evidence before him because he perceived that it was being used by others to reach conclusions with which he disagreed. In one such instance, Jefferson argued that further study was necessary before judgment could be passed; in another, he abandoned empiricism entirely. These sections of the text show us that Jefferson, whom biographers have compared to a sphinx or a Rosetta stone, held a nuanced, and sometimes contradictory, position towards empirical science.

In Query VI , Jefferson considered various speculative theories that had been proffered to explain the surprising presence of marine shells high on the rocks of the Blue Ridge Mountains. A number of significant authorities had used the appearance of these shells to confirm the theory of the Universal Deluge. According to that theory and to the biblical tales that supported it, enormous changes in the surface of the earth were caused by God, who flooded the earth with water in catastrophic events. Jefferson could not bring himself to agree with such theories; he noted, for instance, that "no fact has taken place, either in our own days, or in the thousands of years recorded in history, which proves the existence of any natural agents . . . of force sufficient to heave" the shells to such great heights.

Jefferson cast doubt on the major theories offered to explain such phenomena, but he struggled to find an explanation of his own. In what seemed to many of his contemporaries as a wildly speculative theory, he proposed that the shells could have been formed by the passage of water through limestone. After noting the fantastic shapes of marble deposits in quarries, Jefferson suggested that "nature may have provided an equivalent operation, by passing the same materials through the pores of calcareous earths and stones" (33). He continued:

> and it might be asked, whether it is more difficult for nature to shoot the calcareous juice into the form of a shell, than other juices into the forms of chrystals, plants, animals, according to the construction of the vessels through which they pass?

Jefferson seemed to realize that his own theory was, at best, unsupported conjecture. But finding himself unable to agree with established explanations or to find a convincing alternative, he decided to leave the matter unresolved:

> There is a wonder somewhere. Is it greatest on this branch of the dilemma; on that which supposes the existence of a power, of which we have no evidence in any other case; or on the first, which requires us to believe the creation of a body of water, and its subsequent annihilation? The establishment of the instance, cited by M. de Voltaire, of the growth of shells unattached to animal bodies, would have been that of his theory.

> But he has not established it. He has not even left it on ground so respectable as to have rendered it an object of enquiry to the literati of his own country. Abandoning this fact, therefore, the three hypotheses are equally unsatisfactory; and we must be contented to acknowledge, that this great phaenomenon is as yet unsolved. Ignorance is preferable to error; and he is less remote from the truth who believes nothing, then he who believes what is wrong. (33)

Jefferson argues forcefully that Voltaire's theory has not been established by the empirical evidence. But without enough material to prove his own hypothesis, Jefferson sets up something akin to a legal "burden of proof" in regard to scientific hypothesis. Until that burden of proof is reached, Jefferson writes, it is better to be in a state of ignorance than error; ignorance, after all, represents a condition in which further study is possible, while error presupposes a hardening of conclusions and a resistance to new information. For Jefferson, this was particularly the case when the observable evidence was being used to support a literal interpretation of the bible.

Jefferson's axiom also shows that he was mindful of the dangers inherent in Aristotelian logic at a time when that system, though weakened considerably by Enlightenment critiques, was still taught regularly in schoolhouses and colleges.[41] Since, in that framework, new truths were established by demonstrating their consistency with previously proven truths, a belief in "what is wrong" could beget a derivative chain of

[41] Howell, *Logic and Rhetoric,* 14.

falsehoods.[42] A belief in an erroneous theory was harmful not just because it was wrong, but also because, once it had been accepted as a general truth, it could lead to subsequent erroneous theories, multiplying the original error by a hundredfold. A state of ignorance, by contrast, at least left the slate of experience unchalked by error; and so, in the end, a cautious, meticulous approach was called for -- one that would entail a careful accounting of the natural world, and a judicious use of the scientific method.

While Jefferson left the issue of shell formation unresolved, he abandoned empirical evidence entirely in another section of the work. The table he prepared to refute Buffon's theory of degeneracy in the New World included an entry for the "Mammoth," which he listed at 1800 pounds. Aware that this might arouse suspicion, Jefferson wrote:

> It may be asked, why I insert the Mammoth, as if it still existed? I ask in return, why I should omit it, as if it did not exist? Such is the œconomy of nature, that no instance can be produced of her having permitted any one race of her animals to become extinct; of her having formed any link in her great work so weak as to be broken. To add to this, the traditionary testimony of the Indians, that this animal still exists in the northern and western parts of America, would be adding the light of a taper to that of the meridian sun. (53-4)

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[42] As Locke wrote, "*General Maxims* will *serve* to confirm us in Mistakes; and in such a way of use of Words, which is most common, will *serve* to prove Contradictions." Locke, *Essay*, IV.vii, 604.

Even the most sympathetic critics of Jefferson's work have found it difficult to reconcile the Jefferson who criticized Buffon for neglecting to produce evidence in support of his theories with this uncritical avowal of the "Great Chain of Being."[43] In part, Jefferson was reacting to people who looked at the evidence of fossil layers in geological strata and argued that these layers provided proof of catastrophism. Theories of catastrophism, which held that the earth was only a few thousand years old and that all great changes in animal and mineral species had been caused by divinely wrought cataclysmic events such as the Biblical Deluge, dominated the practice of geology in the eighteenth century. Proponents of catastrophism, for example, would point to a uniform layer of silt over a large area and argue that such a widespread dispersal of sediment could have been deposited only in an event such as the Noahic flood. At about the same time that Jefferson was applying the principles of the Scottish Enlightenment to the state of Virginia, a young Scottish geologist named James Hutton published *Theory of the Earth*. In that complex book, Hutton argued against catastrophism by positing that changes in the earth occurred over millions of years, and that they were caused not by catastrophic events, but rather by gradual forces such as erosion.[44] Although Hutton's book was almost universally regarded as dense and difficult, his ideas proved influential to later geologists such as Charles Lyell, who built upon Hutton's theory to show that the contours of the earth had been formed only by those geological forces that were currently in existence.

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[43] See, for example, Ferguson, 395, Looby, 265, and Regis, 92-3.

[44] John Hedley Brooke, Science *and Religion: Some Historical Perspectives*. New York: Cambridge University Press, 1991, 215.

Ironically, the arguments about fossils to which Jefferson wanted to respond *were* based on empirical evidence. But, because they led to conclusions with which he disagreed vehemently, Jefferson chose to adopt the kind of *a priori*, deist conception of the universe evident in his description of the mammoth. Jefferson's argument that neither animals nor races could go extinct, which flew so flagrantly in the face of the available evidence, was thus an ill-advised effort to resist religious theories of catastrophism. The universe Jefferson described, instead, operated on the classic Deist conception of the universe in which God acts as a clockmaker who creates the world and then steps back to let its mechanisms run undisturbed.

This moment, in which Jefferson rejects the empirical evidence before him, and adopts instead an argument based purely on conjecture, problematizes my reading of Jefferson's *Notes on the State of Virginia* as a "primary node" of the "culture of proof." While the book does feature many examples of the empirical methodologies, it contains, simultaneously, sections that disrupt a smooth reading of Jefferson's stance towards empiricism. In this respect, however, Jefferson's text is a product of its time: although empiricism had emerged as the most reliable method of discovering truth in the world, it was not yet settled law. The "culture of proof" was in the process of emerging, but its birth was marked by a sometimes troubled and difficult labor.

In Quest of Passage: Composing the Eye

As exemplified both by Jefferson's compass rose and by his tables of statistics in *Notes on the State of Virginia*, empirical science often depended upon the use of tools to gather accurate measurements. In a well-known passage in Query IV, Jefferson abandons that kind of statistical analysis, and instead emphasizes vision as the primary means of knowledge-gathering. As Jefferson describes the route of the Potomac River through the Blue Ridge Mountains, he switches abruptly to a second-person voice and tries to recreate the visual panorama for his readers:

> The passage of the Patowmac through the Blue ridge is perhaps one of the most stupendous scenes in nature. You stand on a very high point of land. On your right comes up the Shenandoah, having ranged along the foot of the mountain an hundred miles to seek a vent. On your left approaches the Patowmac, in quest of a passage also. In the moment of their junction they rush together against the mountain, rend it asunder, and pass off to the sea. The first glance of this scene hurries our senses into the opinion, that this earth has been created in time, that the mountains were formed first, that the rivers began to flow afterwards, that in this place particularly they have been dammed up by the Blue ridge of mountains, and have formed an ocean which filled the whole valley; that continuing to rise they have at length broken over this spot, and have torn the mountain down

> from its summit to its base. The piles of rock on each hand, but particularly on the Shenandoah, the evident marks of their disrupture and avulsion from their beds by the most powerful agents of nature, corroborate the impression. (19)

In this first, quasi-cinematic description of the "stupendous scene," Jefferson writes in a proto-scientific mode of observation by standing inside the field of description, looking at the collision of rocks and water. Jefferson's narrative sets up what will turn out to be a mistaken impression: "that this earth has been created in time, that the mountains were formed first, that the rivers began to flow afterwards...." As he pauses, and looks more closely at the scene before him, he comes to a new understanding of the formation of the riverbed:

> But the distant finishing which nature has given to the picture is of a very different character. It is a true contrast to the fore-ground. It is as placid and delightful, as that is wild and tremendous. For the mountain being cloven asunder, she presents to your eye, through the cleft, a small catch of smooth blue horizon, at an infinite distance in the plain country, inviting you, as it were from the riot and tumult roaring around, to pass through the breach and participate of the calm below. Here the eye ultimately composes itself; and that way too the road happens actually to lead. (19)

Many critics have attempted to situate the Potomac passage within late eighteenth and early nineteenth-century arguments about geologic catastrophism and uniformitarianism. Problematically, Jefferson's rhetoric engages both sides of the debate. His first glance of the Potomac evokes catastrophism: he suggests that the river dammed, filled the valley, and finally tore down the mountain in a cataclysmic flood. But Jefferson undercuts that interpretation, and divorces it from the auspices of divine intervention, when he writes that "this earth has been created in time." Running counter to the catastrophic argument, this statement suggests that geological changes are caused by earth-bound processes operating over a significant length of time.

Jefferson revises that interpretation, however, in the second passage. There, he suggests that the "riot and tumult" of the foreground is resolved by the "small catch of smooth blue horizon" in the distance. From this "infinite" vantage point, the geological violence described earlier becomes reconciled with the overall clarity and sublimity of providential design. Seen from this divine prospect, the tumult of the river's path is ordered and put into proper perspective; it is from this transcendent, deific vista that "the eye ultimately composes itself."

Using this passage to trace Jefferson's own conflicted views on geological change, critics have been led, predictably, into rhetorical knots. Elisa New writes that Jefferson "uses the idiom of catastrophism to make a uniformitarian case . . . . Evocations of geological convulsion are coordinated to permit experience of creation's momentous power...."[45] Such confusion is not surprising, and may have even been Jefferson's larger point: the Potomac looked as if it could have been formed in different ways, depending

[45] New, 395.

upon the angle from which it was viewed. What was important to Jefferson was not only that all angles be considered, but also that the scene be viewed in a literal sense. He closed his geological speculations with the comment that "This scene is worth a voyage across the Atlantic" -- a blatant bit of tourist advice for the members of his European audience, whom he hoped would come to see "one of the most stupendous scenes in Nature" for themselves. A view of this scene, he implied, had the potential to put to rest a number of longstanding geological controversies.

One feels Jefferson striving to recreate, in words, the kind of empirical, visual documents that the photographic camera would later make possible. He begins by describing the Potomac cinematically -- images of mountains and seas roll quickly before the viewer, but ultimately "hurry the senses" into a mistaken impression. Jefferson slows down time in the second passage and presages the ways in which the photographic camera would capture images of nature and allow the eye to linger over their smallest details. Jefferson thus foregrounds the importance of vision into his empirical project, and becomes, in effect, a kind of camera for his readers. Writing in the second person, we see the scene through his eyes; our sense of the landscape depends entirely upon his reliability as a visual witness. It is perhaps for this reason that he chose to buttress that reliability by appending a second visual account of the Potomac to his text.

The Thompson Appendix: Positioning the Observer

Upon finishing his manuscript in 1781, Jefferson sent it to Marbois and asked the Frenchman to show it to several friends, including Charles Thomson.[46] The Irish-born Thomson was the secretary to the Continental Congress in Philadelphia. He was one of the two signers of the original Declaration of Independence, and is credited with designing the "E Pluribus Unum" seal of the United States. Thomson was also an expert on Indian affairs, and an adopted member of the Delaware tribe. Both Thomson and Jefferson were councilors in the American Philosophical Society; Jefferson wanted Thomson to see his manuscript because he hoped to contribute it to the Society. Thomson read Jefferson's manuscript with interest, and provided him with a set of written observations on it. Jefferson thought Thomson's commentary valuable enough to append passages from it to both the first 1785 edition of the book and the Stockdale edition of 1787. Considering that Thomson's words appeared in Jefferson's approved editions of the text, the lack of critical attention they have received is surprising.

The Thomson appendix is comprised, for the most part, of reactions to those parts of Jefferson's manuscript that deal with Native American tribes; Thomson's expertise on Indian affairs, we might surmise, was one of the primary reasons why Jefferson was interested in Thomson's feedback. But Thomson's commentary also covers the Potomac passage, and Jefferson felt that Thomson's notes had "too much merit not to be communicated" (197).

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[46] This synopsis of Thomson's life and his role in producing the appendix is taken from William Peden's notes to Jefferson's book. Jefferson, *Notes*, 296n1.

Thomson's commentary on this section echoes Jefferson account to a surprising degree; his first sentence neatly reenacts Jefferson's first impression of the scene:

> The reflections I was led into on viewing this passage of the Patowmac through the Blue ridge were, that this country must have suffered some violent convulsion, and that the face of it must have been changed from what it probably was some centuries ago: that . . . in short, every thing on which you cast your eye evidently demonstrates a disrupture and breach in the mountain, and that, before this happened, what is now a fruitful vale, was formerly a great lake or collection of water, which possibly might have here formed a mighty cascade, or had its vent to the ocean by the Susquehanna, where the Blue ridge seems to terminate. (198)

Like Jefferson, Thomson grounds his argument in visual, empirical evidence: his emphasis on what could be "evidently demonstrate[d]" to the eye signals to the reader that he has been in the field and observed the phenomena in question: Thomson's account seems credible because he presents it as an eyewitness report, grounded in his personal authority as a witness.

Jefferson might have wanted to include Thomson's remarks because he hoped to buttress his visual observations with those of another writer. Relying not on the permanent empirical evidence that a photograph would later be able to supply, but rather on the sense impressions of the idiosyncratic eye, Jefferson may have felt that another view was need to corroborate his claims. But, where the "small catch of smooth blue

horizon" caused Jefferson to revise his first impression, Thomson never wavers. Instead, he argues that the fact that "other parts of this country . . . bear a like convulsion" (198) suggest that the Potomac was formed by floodwaters that built up over time. He goes on to describe the formation of the Delaware, and remarks several bits of evidence which suggest that "the river must have opened its way through a different part of the mountain, and . . . deluged the country below with the immense collection of waters to which this new passage gave vent" (198). Thomson's account, then, which was intended to corroborate Jefferson's impression of the scene, actually undercuts it by refusing Jefferson's "smooth blue horizon."[47]

But Thomson's observations take a remarkable turn of their own towards the end of his commentary on this section of Jefferson's text. In an extraordinary moment, possibilities of geological change lead Thomson to posit a flight of fancy rooted in imperial vision:

> What a change would it make in the country below, should the mountains at Niagara, by any accident, be cleft asunder, and a passage suddenly

[47] In this sense, the Thomson appendix performs a role similar to that of the appendices Jefferson included on the murder of Chief Logan's family. In the 1787 Stockdale edition of his book, Jefferson attempted to rebut the criticism of Buffon by including an eloquent speech by Chief Logan, an Indian from the Mingo tribe whose family was murdered in 1774. The version of the speech Jefferson placed in *Notes on the State of Virginia*, which he derived from contemporaneous newspaper accounts of the incident, placed the blame for the massacre on Captain Michael Cresap. In 1797, after Jefferson became Vice-President, his political enemies accused him of slandering Cresap, whom they suggested was innocent of the murders. In an attempt to shore up the credibility of his account, Jefferson added a series of a series of supposedly eyewitness accounts of the incident to the 1800 edition of his book. However, the conflicting nature of these accounts only further complicated the reliability of his own version of the story. For further information, see Peden's editorial commentary on pages 298-300 in Jefferson, *Notes*.

> opened to drain off the waters of Erie and the Upper lakes! While ruminating on these subjects, I have often been hurried away by fancy, and led to imagine, that what is now the bay of Mexico, was once a champaign [sic] country; and that from the point or cape of Florida, there was a continued range of mountains through Cuba, Hispaniola, Porto rico [sic], Martinique, Guadaloupe, Barbadoes, and Trinidad, till it reached the coast of America, and formed the shores which bounded the ocean, and guarded the country behind: that, by some convulsion or shock of nature, the sea had broken through these mounds, and deluged that vast plain, till it reached the foot of the Andes; that being there heaped up by the trade-winds, always blowing from one quarter, it had found its way back, as it continues to do, through the gulph between Florida and Cuba, carrying with it the loom and sand it may have scooped from the country it had occupied, part of which it may have deposited on the shores of North America, and with part formed the banks of Newfoundland. -- But these are only the visions of fancy. (199)

Spurred on by Jefferson's depiction of a swollen Potomac bursting through a mountain range, Thomson imagines two of the Great Lakes spilling over the peaks of Niagara. This leads him towards a more ambitious fantasy. Although he dismisses it as the product of a passing "fancy," Thomson's vision seems to re-enact a scene of colonial invasion. In his daydream, the waters of North America burst the seams of mountain ranges and spread forth across South America until they reach the foot of the Andes.

Having explored the southern continent to its most distant point, the waters splash up against a distant mountain range, and, like colonists bringing the raw, fertile resources of a pillaged continent back towards the hub of an empire, the water carries with it the "loom and sand it may have scooped from the country it had occupied," and "deposits" them on the shores of North America. The words "occupied" and "deposits" take on sinister shades of meaning in this context, as they could just as easily describe the workings of an imperial economy as the actions of ocean waves on silt. Of course, at the time of Thomson's writing, the United States held relatively little of the North American continent; yet his vision remains a decidedly imperial imagining of power, and one that would turn out, in its way, to prefigure the colonial reach of the nation whose constitution he signed.

Thomson's reference to Newfoundland is significant in this respect. After centuries of raids and fishing expeditions by Basque, Portuguese, Spanish, British and French colonists, Newfoundland was awarded to the British in 1713 as part of the Treaty of Utrecht, which ended the War of Spanish Succession. Under the terms of the treaty, France ceded to Britain all claims to the land. By the 1780s, however, Newfoundland had again become an object of colonial interest, partly due to the effects of the American and French revolutions on European fisheries.[48] Thomson's vision of Newfoundland's banks being formed by the action of North American waters on South American silt is certainly significant when one considers that it is closer to Europe than any other part of the North American continent. By staking an imaginative claim to a disputed region of

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[48] *Newfoundland and Labrador Heritage: Explorations and Settlements*, Memorial University of Newfoundland, 29 September 2004 <http://www.heritage.nf.ca/exploration/default.html>.

the empire from which the colonies had just declared their independence, Thomson helps turn the new nation from colonized to colonizer, and he naturalizes that shift by couching its agency in the organic processes of geological change. Thomson's appendix suggests the ways in which America, retooled as an imperial power, would soon reshape political and geographical boundaries on a global scale. That it did so under the banner of empirical science is hardly surprising, given the ways in which scientific explorations of the period were often expected to confirm the ideologies of colonialism.[49]

The Natural Bridge

Jefferson's description of the Natural Bridge provides another example of his relentless pursuit of empirical data. Although it is not usually interpreted as an example of Jefferson's empirical project, his description of the Natural Bridge forms a contrast to his discussion of the Potomac, which departs from much of *Notes on the State of Virginia* in its explicit turn away from natural facts towards an aesthetic vision that is resolved in the tranquilizing palliation of divine will. In contrast to that episode, Jefferson's description of the Natural Bridge, so famous among scholars for its depiction of the sublime, is grounded in the presentation of empirical proof. While his words on the sublime are often quoted, the full passage provides a broader context of the scene:

[49] See Kris Fresonke's *West of Emerson* for a recent exploration of this theme in an American context.

The fissure, just at the bridge, is, by some admeasurements, 270 feet deep, by others only 205. It is about 45 feet wide at the bottom, and 90 feet at the top; this of course determines the length of the bridge, and its height from the water. Its breadth in the middle, is about 60 feet, but more at the ends, and the thickness of the mass at the summit of the arch, about 40 feet . . . . The arch approaches the Semi-elliptical form; but the larger axis of the ellipsis, which would be the cord of the arch, is many times longer than the semi-axis which gives it's [sic] height. Though the sides of this bridge are provided in some parts with a parapet of fixed rocks, yet few men have resolution to walk to them and look over into the abyss. You involuntarily fall on your hands and feet, creep to the parapet and peep over it. Looking down from this height about a minute, gave me a violent head ach [sic]. This painful sensation is relieved by a short, but pleasing view of the Blue ridge along the fissure downwards, and upwards by that of the Short hills, which, with the Purgatory mountain is a divergence from the North ridge; and, descending then to the valley below, the sensation becomes delightful in the extreme. It is impossible for the emotions, arising from the sublime, to be felt beyond what they are here: so beautiful an arch, so elevated, so light, and springing, as it were, up to heaven, the rapture of the Spectator is really indiscribable! [sic] The fissure continues deep and narrow and, following the margin of the stream upwards about three eights [sic] of a mile you arrive at a limestone cavern,

> less remarkable, however, for height and extent than those before described. (24-25)

Jefferson approaches the Natural Bridge as a surveyor, carefully noting its dimensions and physical attributes, and delineating its geometrical form. It could be argued that Jefferson's mathematical sketch of the bridge proves inadequate to its grandeur, which is why Jefferson approaches for a closer "look over into the abyss." Although the rush of Jefferson's headache shears away the careful measurements taken earlier, Jefferson does not allow his swoon to completely disrupt his survey: as Garry Wills notes, it is characteristic of Jefferson to measure the length of time he felt outside of time ("about a minute").[50] And no sooner has he reached the height of his rhetoric ("springing, as it were, up to heaven..."), then he returns to the mundane diction of geographical survey ("following the margin of the stream upwards about three eights of a mile...").[51] The violent headache certainly disrupts Jefferson's dry accounting of distances and heights, but he makes an important effort to return to the mode of empirical survey before ending the passage. Although a sense of the sublime cannot be completely contained within a rational, empiricist framework (and in some ways depends upon an escape from it),

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[50] Garry Wills, *Inventing America: Jefferson's Declaration of Independence*. Garden City, N.Y. : Doubleday, 1978, 271.

[51] I quote here from the revised version of Jefferson's manuscript used in Peden's definitive edition of the *Notes*. It is important to note, however, that the original draft of this passage also ended on a note of mathematical precision: "The fissure continuing narrow, deep, and straight for a considerable distance above and below the bridge, opens a short buy very pleasing view of the North mountain on one side, and the Blue ridge on the other, at the distance each of them of about five miles." Quoted in Wills, 262.

Jefferson submerges his description of the spectacle within the discourse of scientific measurement and analysis.

The topographical details of the scene, as Leo Marx has pointed out, "establish a firm naturalistic base for [the] utopian revery" of Jefferson's sublime observation.[52] It is as if, in America, the sublime could not be experienced prior to being set within the grounding proof of scientific evidence. Before making claims about the power of the American landscape, writers first had to prove, through the use of careful measurement, that geographical features of such magnitude actually existed. Locke's proposition that "in the beginning, all the world was America," points to this quality of the young nation: to European eyes, America seemed to demand the inductive Baconian method because it appeared new and unglossed by the hoary patina of syllogistic truths. Truth could not be derived from previous truths in America, in other words, because those previous truths had not yet been firmly established. Even the "self-evident" truths that Jefferson described in the "Declaration of Independence" remained untried propositions until the new nation proved their verity to the world. The Natural Bridge was, in many ways, the perfect symbol for the nation because the structure itself, built by nature rather than man, had the potential to become a self-evident maxim from which subsequent truths could be derived. As Bacon wrote in the very first aphorism of *Novum Organum*, "Man is Nature's agent and interpreter; he does and understands only as much as he has observed of the order of nature in fact or by inference; he does not know and cannot do more."[53]

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[52] Marx, 120.

[53] Bacon, *Novum Organun*, 33.

Scholars have generally attributed Jefferson's sense of the sublime to his reading of Edmund Burke's 1757 *Philosophical Enquiry into the Origin of the Sublime and the Beautiful*. Garry Wills notes that Jefferson considered Burke's book on the sublime important enough to include as one of only seven works on the "fine arts" on the 1771 list of essential books that he compiled for Robert Skipwirth.[54] In a more recent study of Jefferson's *Notes,* Matthew Cordova Frankel argues that the Kantian sublime "illuminates the details of Jefferson's self-profile more adequately than the more obvious Burkean model."[55] The strength of Frankel's point is undercut, however, by the fact that the book in which Kant lays out that theory, *The Critique of Judgment*, was not published until 1790, after Jefferson's book had been written and published. If we want to look for an alternative to the dominant attribution of the Burkean sublime as the source for the Natural Bridge section of *Notes on the State of Virginia,* I would suggest, we need look no further than the list of seven essential books on the fine arts that Jefferson sent to Skipwirth.

Among those seven books was Lord Kames' *Elements of Criticism*, first published in 1762, almost twenty years before Jefferson wrote *Notes on the State of Virginia*. Lord Kames, named Henry Home at birth, was an older cousin of David Hume (who altered the spelling of his last name to match its pronunciation).[56] An important leader of the Scottish Enlightenment, Kames has been described as "an intellectual hero of the young Jefferson," who, in his early writings, often quoted and recommended the

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[54] Wills, 270. The full list of books can be found in Jefferson, *Writings*, 740-745.

[55] Frankel, 710. Further citations will appear in the text.

[56] Wills, 198.

philosopher.[57] Kames devoted a chapter of *Elements of Criticism* to the subject of "Grandeur and Sublimity." In it, he laid out a theory of the sublime that, while not superseding the importance of Burkean sublime, should at least be considered in relation to Jefferson's discussion of the Natural Bridge, given Jefferson's interest in his work.

Whereas Burke's sublime emphasizes the virtual experience of pain -- the sensation of knowing that pain and danger exist without actually experiencing them -- Kames posits that the sublime "is a species of agreeableness," that it is, in other words, derived from sensations of pleasure rather than pain.[58] Kames posits, following Longinus, that the sublime is elicited by regularity of proportion in works of art, and "grandeur and magnificence" in works of nature. Kames's description of the sublime is helpful in piecing together two aspects of Jefferson's description of the natural bridge: his survey of the dimensions of the bridge, and his famous headache.

Kames's discussion of grandeur and the sublime centers on the issue of regularity of shape. He explicates his ideas by suggesting an experiment: "approaching to a small conical hill, we take an accurate survey of every part, and are sensible of the slightest deviation from regularity and proportion" (215). Jefferson's account of the Natural Bridge echoes this kind of empirical procedure: he begins with measurements ("The fissure, just at the bridge, is, by some admeasurements, 270 feet deep, by others only 205") and notes the irregular dimensions he finds ("The arch approaches the Semi-

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[57] Wills, 201. On the influence of Lord Kames on Jefferson's thought, see Wills, 197-199 and 200-05; Koch, 17-19; and Alexander Broadie, "Reid in Context," in *The Cambridge Companion to Thomas Reid*, ed. Terence Cuneo and René Van Woudenberg. Cambridge: Cambridge University Press, 2004: 31-52; 46.

[58] Henry Home (Lord Kames), *Elements of Criticism*, vol. 1. 1762; London: Routledge, 1993: 217. Further citations shall appear in the text.

elliptical form; but the larger axis of the ellipsis, which would be the cord of the arch, is many times longer than the semi-axis which gives it's *[sic]* height). As Kames notes, however, objects need less regularity of proportion to achieve the sublime as their size increases (215). Kames writes:

> The bulk of the objects in a natural landscape are beautiful, and some of them grand: a flowing river, a spreading oak, a round hill, an extended plain, are delightful. . . joining to these the verdure of the fields, the mixture of light and shade, and the sublime canopy spread over all; it will not appear wonderful, that so extensive a group of splendid objects, should swell the heart to its utmost bounds, and raise the strongest emotion of grandeur. The spectator is conscious of an enthusiasm, which cannot bear confinement, nor the strictness of regularity and order: he loves to range at large; and is so enchanted with magnificent objects, as to overlook slight beauties or deformities. (215-216)

Kames' discussion of grandeur and the sublime helps contextualize and resolve two conflicting impulses in Jefferson's description of the Natural Bridge: his urge to survey the Bridge mathematically -- to contain its immensity with numbers -- and his complete abandonment of that circumscribing impulse as the view from the top of the bridge leads him towards an "indiscribable" rapture. Kames' description of the sublime might have appealed to Jefferson precisely because it allowed him to elide the discrepancy between his scientific impulse to define the limits of the bridge with numbers, and his romantic

impulse to break out from those restraints to express his wonder at the beauty of the bridge.

In his article, Frankel attempts to delineate the political aspects of Jefferson's sublime as displayed in his description of the Natural Bridge. Drawing upon recent work on nationalism and citizenship, Frankel argues that soon after the American revolution, the new nation, lacking a single, centralized source of power such as a monarch, had trouble organizing and ensuring the political allegiance of its polity (698-9). Frankel turns to the historian Peter Parrish, who has written that "from the outset, the United States had a political structure with the potential -- no more than that -- for nationhood but took several decades to evolve a full national self-consciousness: that is to say, to become in the full sense an imagined community."[59] In a country unable to coerce the wills of its citizens, according to Frankel, republican institutions tried to evoke the political self-consciousness of its citizens by seeking a "reliable spiritual supplement" (700).

Frankel reads Jefferson's description of the Natural Bridge as the key textual moment in which Jefferson transforms American nature into a common vehicle for citizenship. He writes that "it is only through the sublime...that each new American subject may experience nature's moral and institutional prescriptions as a single interior command, which, once complete translates the psychic demands of citizenship into an aestheticized moment of surrender" (709-10). Indeed, Jefferson's sublime moment on

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[59] Peter J. Parish, "An Exception to Most of the Rules: What Made American Nationalism Different in the Mid-Nineteenth Century?" *Prologue* 27 (Fall 1995): 219-229; 220. Parish refers to Benedict Anderson's theory of "imagined communities," explained in *Imagined Communities: Reflections on the Origin and Spread of Nationalism*. New York: Verso, 1983.

top of the bridge becomes, for Frankel, a moment of supreme importance, *the* scene upon which the entire import of *Notes on the State of Virginia* seems to rest. He writes:

> Thus, Jefferson's progression from fear to rapture can be more clearly seen as contingent on his ability to represent in himself a holistic picture of the natural (and national) landscape. . . . Insofar as the representative's task was to harmonize "the people" under a single transcendent concern, Jefferson takes his perch on the Natural Bridge as an exercise in imaginative unification. Set in the American wilderness, that place of terror and awe open both to the scientist and the ploughman, Jefferson's sublime affords the new subject an opportunity for harmonizing the disparate elements of perception into his unified purview. (713-4)

Frankel argues that the Kantian sense of sublime provides a model for the transfer of reference from a local to a national level that he sees in Jefferson's representation of the Natural Bridge. Just as Kant understood the sublime to be elicited by local impressions, but to give rise to the "universal, though subjective, condition of reflective judgments,"[60] so Frankel sees Jefferson's presentation of the sublime in a local Virginian setting to be transferred to the citizenry on a national level.

Frankel errs when he writes that "Jefferson's sublime reflection precedes his empirical investigations, initiating his scientific method with a visceral prologue" (712).

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[60] Immanuel Kant, *The Critique of Judgment*, trans. James Creed Meredith. Oxford: Oxford University Press, 1952, 32.

The description of the Natural Bridge, after all, appears at the end of Query IV, long after Queries I, II, III, as well as the bulk of Query IV, have grounded the work in empirical methodology. The very first sentence of the text sets forth Jefferson's quantitative bent: "Virginia is bounded on the East by the Atlantic: on the North by a line of latitude, crossing the Eastern Shore through Watkins's Point, being about 37º . 57'." Contrary to Frankel's claim, then, Jefferson's sublime occurs within an already-established empirical framework; the scientific method conditions Jefferson's sublime, rather than the other way around. It would be more accurate, then, to say that Jefferson's sublime reflection represents an atypical break in his empirical method, and that its power depends on a departure from the painstaking presentation of evidence that is more characteristic of the work.

While Frankel's assertion is problematic, his article is indicative of a more serious problem in the critical reception of *Notes on the State of Virginia*. Such work tends to emphasize the importance of narrative passages such as the Natural Bridge and the Potomac River at the expense of the scientific catalogues that abound in the text. As Pamela Regis points out in *Describing Early America*, "in the 300-page work, just three paragraphs -- which anthologists have turned into Jeffersonian set pieces -- have received the bulk of critics' attention." This has led to a "a misrepresentative criticism that leaves most of the book unread."[61] In the case of the Natural Bridge, the situation is even more pronounced: critics, preoccupied with Jefferson's use of the sublime, have attempted to stretch four sentences into a "sustained psychic episode," as Frankel would

[61] Regis, 81.

have it,[62] leaving the remainder of Jefferson's description -- and, hence, for example, his situation of the sublime within the culture of proof -- virtually unread.

Most of the passages to which critics have repeatedly turned involve moments in which the normally private Jefferson reveals insight into his personal or political beliefs. And within such narrative passages, scientific details such as Jefferson's measurements of the Natural Bridge tend to be overlooked in favor of more dramatic moments, such as Jefferson's headache. In their excitement to get at Jefferson the man, scholars have slighted Jefferson the scientist. Since many such analyses were written by scholars in literary fields, that is perhaps unsurprising: the prevailing feeling among critics writing about Jefferson's book seems to have been that there is nothing much to say about lists of vegetables, flowers, and animals; or, at least, that much more can be said about moments in which Jefferson seems to lead the reader into a revelation of personal weakness, as he does in the Natural Bridge passage.

This sort of criticism was set in motion, ironically, by William Peden, the very scholar who popularized Jefferson's book in the twentieth century. At the time Peden produced his 1954 edition of the book, which is now considered the definitive text, *Notes On the State of Virginia* had not been produced under separate cover for sixty years. Yet Peden began his introduction to the book by minimizing the importance of Jefferson's statistical and informational tables, claiming that the book was notable primarily for those sections in which Jefferson disclosed his major beliefs on politics, government, religion, and slavery. While Peden respectfully remarked upon Jefferson's scientific abilities, his

[62] Frankel, 710.

introduction suggested that the wealth of natural facts in the book obscured its true value. Peden wrote:

> Anyone interested in Jefferson and his times will find the *Notes on Virginia* an indispensable book. It is, moreover, a remarkably lively and entertaining one. In spite of its statistics, which are of little interest to the lay reader, the *Notes on Virginia* is a book for *today*; it is valuable both as an introduction to Jefferson and as a commentary on problems as relevant to our own generation as they were to his. (xi)

Seeking a popular audience for Jefferson's work, Peden emphasized those aspects of Jefferson's book that seemed relevant to readers in the 1950s.[63] But prizing the modern relevance of the text -- its revelations about Jefferson's political and social beliefs -- came at the price of the scientific context of the work. Peden feared, most likely with good reason, that in order to enjoy the book, modern lay readers would have to overlook the tables of statistics and natural phenomena that filled its pages; if they found pleasure in the text, it would be "in spite of its statistics," not because of them.

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[63] For the purposes of increasing the readership of Jefferson's work -- or, it must be said, for the purposes of increasing sales -- perhaps Peden was right to emphasize the narrative-oriented portions of Jefferson's text. The place of *Notes on the State of Virginia* in early American scholarship owes a deep debt to Peden's work. But it must be noted that the tone of that scholarship was set, in the beginning, from the first modern edition of the book. If critics have overlooked the importance of Jefferson's work on natural history, some of the blame must unfortunately be laid at the doorstep of one of the founding fathers of the field.

This value-judgment, however, is diametrically opposed to the judgments made by Jefferson's contemporaries. In fact, what many late-eighteenth century readers valued about the book were those sections of the text deemed most inimical to readers in the middle of the twentieth century. As Peden points out, *Notes on the State of Virginia* was prized in its time as "a popular handbook of natural science and geography" (xxv).[64] The book seemed important to Jefferson's contemporaries for the wealth of information it contained about Virginia's natural resources, not because it was "one of the first masterpieces of American literature," as some later critics would have it.[65] It is under the heavy weight of such literary expectations that modern readers have slighted crucial passages in the text, passages that were deemed central to the book at the time and that helped lay the groundwork for the culture of proof in America. The empiricism of Jefferson's text, as I will argue in the next section, provided a new, pragmatic model of citizenship its readers.

Science and Citizenship

Despite the attention his book received -- or perhaps because of it -- Jefferson often denigrated his work. He frequently emphasized its incompleteness, famously

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[64] Merrill Peterson has pointed out that when Jedediah Morse, known as "the father of American geography," published his ground-breaking work in 1785, he accounted for Virginia's vast territories by simply reprinting Jefferson's work on the subject. Peterson, 265.

[65] Gilbert Chinard, *Thomas Jefferson, the Apostle of Americanism*. Boston: 1929, 118.

referring to it as "this trifle" and "nothing more than the measure of a shadow."[66] The most obvious indication that Jefferson felt that his work was unfinished can be seen in the title of the book. By calling it "Notes" on Virginia, rather than a "History" or "Natural History" of the state, Jefferson did more than indicate his own gentlemanly discomfort with the tawdry public sphere of publication, as one critic has suggested, or refer to the circuitous and unauthorized manner in which the book was first published.[67] Jefferson was, as Robert Ferguson has noted, "a man obsessed by notions of design, system, measurement, and style;" if the work was incomplete, that was because it was incomplete by design.

Jefferson was painfully aware that any human effort to encompass the bounty of nature in a printed text was doomed to incompletion. Instead of letting this constraint deter him, Jefferson engaged it as an opportunity. When he first published his text after arriving in France in 1785, he paid for two hundred copies of the book; included among that number were "just copies enough for every young man at the College [of William and Mary]."[68] Jefferson may have hoped that the rising generation would work to complete the unfinished project he had started -- not only to try to eradicate slavery, but also to expand the catalogues of natural facts that filled so many pages of his text. The value of Jefferson's lists depended ultimately upon the active engagement of succeeding generations of naturalists.

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[66] TJ to James Madison, 8 Feb. 1786, *Writings*, 849; TJ to John Melish, 10 Dec. 1814, in Andrew A. Lipscomb and Albert E. Bergh, eds., *The Writings of Thomas Jefferson*, 20 vols. (Washington, D.C.: Thomas Jefferson Memorial Association, 1905), XIV, 220.

[67] Ferguson, 382-3.

[68] TJ to Chastellux, 7 June 1785. Jefferson, *Writings*, 800.

Jefferson fore-grounded the arbitrary nature of such catalogues by refusing to rely on one single taxonomic system in his book, referencing in the course of the text the orders of Linnaeus, Millar, Catesby, and Clayton, as well as the common names for vegetables and animals. In an 1814 letter to Dr. John Manners, Jefferson clearly acknowledged that such systems were built upon idiosyncratic premises:

> Nature has, in truth, produced units only through all her works. Classes, orders, genera, species, are not of her work. Her creation is of individuals. No two animals are exactly alike; no two plants, nor even two leaves or blades of grass; no two crystallizations....[As] we [form] what we call a system of classes, orders, genera, and species....we fix arbitrarily on such characteristic resemblances and differences as seem to us most prominent and invariable in the several subjects, and most likely to take a strong hold in our memories...Nature has not arranged her productions on a single and direct line. They branch at every step, and in every direction, and he who attempts to reduce them into departments, is left to do it by the lines of his own fancy.[69]

Having recognized that all categorizations of animals and plants are human constructions, Jefferson asserted that the value of the Linnaean system lay in its ability to enable communication between naturalists, to serve as a "universal language" for practitioners in

[69] TJ to Dr. John Manners, 22 February 1814. Jefferson, *Writings*, 1329-30.

the field.[70] Because of its widespread use among naturalists, the Linnaean system had the ability to rally "all to the same names for the same objects, so that they could communicate understandingly on them."[71] The reasoning behind Jefferson's approval of Linnaeus' nomenclature, then, was social rather than scientific -- what was most important to him was that the language of science enabled the creation of an active community, in which a large group of participants could contribute to a shared body of knowledge.

Jefferson also liked the Linnaean system because it was flexible, and admitted "supplementary insertions as new productions are discovered."[72] For Jefferson, classificatory systems, like his book, were fundamentally unfinished and open-ended. The continual growth of such systems, and the science which was based on them, therefore depended on a continual adjustment and retooling of its classificatory languages, and on the active participation of a social group of naturalists. Moments of discovery and ordering, then, became moments of liberation because they pointed to an ongoing process of evidence gathering, cataloguing, and comparison. And as Jefferson made clear in *Notes on the State of Virginia*, the fate of the nation was inextricably tied to its natural resources, which both evinced its fertility and articulated its promise. Even as his book, with its advocacy for empiricism, and its occasional turns away from it, exemplified the early stages of the culture of proof, Jefferson showed that the communal project of science could provide a model for the country's evolving sense of self. As new

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[70] Jefferson, *Writings*, 1333.

[71] Jefferson, *Writings*, 1330.

[72] Jefferson, *Writings*, 1333.

generations of American scientists worked together to explore the continent and catalogue its natural facts, they would take part in a new kind of citizenship. The ideal of participatory citizenship proposed in *Notes of the State of Virginia* was embodied not by Jefferson's individual experience of the sublime on top of the Natural Bridge, or even by the yeoman farmer, but rather by the joint, communal endeavor of natural science. The culture of proof, based on Enlightenment principles and put into practice by a community of naturalists, would thus be woven collaboratively into the social, political, and economic fabric of the early republic.

Chapter 2

The American Journal of Science: Building Cultures of Proof

The robust American scientific community that Thomas Jefferson projected in *Notes on the State of Virginia* began to take actual shape during the first few decades of the nineteenth century. As Americans turned their attention from the battlefields of the War of 1812 to the battle-scarred rocks and soil that lay beneath them, national pride and an international embargo helped spur progress in the sciences. New avenues of education helped professionalize the study of science, which had been largely the pursuit of dedicated hobbyists. Whereas the typical eighteenth-century scientist was a gentlemen scholar who worked out of a home laboratory and considered himself a "natural philosopher," universities became centers for scientific learning and experimentation in the first decade of the nineteenth century.[73] Such institutions had to be built from the ground up; when Yale President Timothy Dwight appointed Benjamin Silliman to a full-time professorship in Natural Philosophy and Chemistry in 1802, Silliman assumed one of only twenty-one full-time scientific jobs in the country.[74] By 1821, the scientific profession had expanded so dramatically that there were more jobs in the natural sciences than there were people to fill them. During roughly the same period, the number of professional scientific societies tripled, and the number of scientific journals, important

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[73] George H. Daniels, *American Science in the Age of Jackson*. New York: Columbia U.P., 1968; 7-9.

[74] Daniels, 13-14.

benchmarks for any developing discipline because of the systems of peer communication and review that they initiate, began to multiply.

Few scientists of the era did more to promote American science and advance the "culture of proof" in the early nineteenth century than Silliman, who molded an entire generation of researchers from his post at Yale. Remembered less for his own discoveries than for his influence as a teacher and a popularizer of science, Silliman traveled around the country, presenting lay audiences with chemical demonstrations and exhibitions of rare geological specimens. His legendary lectures at Yale inspired a number of important American scientists, many of whom would eventually contribute to antebellum debates over science and religion -- an interest that Silliman, a devout Christian, shared and fostered. Even a partial list of Silliman's students reads like a who's who of early nineteenth-century scientists: Samuel F.B. Morse, Amos Eaton, Edward Hitchcock, Charles Upham Shepard, James Dwight Dana, and Denison Olmsted all studied with him, as did future politicians such as John C. Calhoun.[75]

Silliman's most important legacy, however, was his founding of *The American Journal of Science* in 1818, which helped summon into being a broad, nationally-based association of professional scientists, and provided a communal space in which they could share research with one another. Indeed, one historian has suggested that this journal might have been "the greatest single influence in the development of an American scientific community."[76] Despite the historical importance of a journal that was the first American scientific periodical to reach a nation-wide audience, its place in the history of

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[75] Chandos Michael Brown, *Benjamin Silliman: A Life in the Young Republic*. Princeton: Princeton U.P., 1989; xiii.

[76] Daniels, 18.

American science has never been adequately examined. Through a close reading of the contents of the journal during its first few years of operation, this chapter will explore the ways in which it fostered a community of scientists and instilled within it a commitment to empiricist methodologies. By providing a common organ through which they could share that evidence and communicate local knowledge to a national audience, the journal played an essential role in promoting a "culture of proof" in America.

Beginnings: Creating a National Dialogue

The American Journal of Science grew out of another scientific publication of the time, Archibald Bruce's *The American Mineralogical Journal*. Bruce, a New York medical doctor and a Professor of Mineralogy at The College of Physicians and Surgeons of the State of New York, founded his journal in 1810. Though it lasted only four years and achieved limited circulation during that time, Bruce's journal was remarkably specialized for a country that had few professional mineralogists.[77] Even if it reached few readers, however, it reached the right ones. Among the subscribers who contributed articles were Benjamin Silliman and Colonel George Gibbs; the latter was a wealthy amateur mineralogist who helped build Yale's mineralogical collection when he donated his cabinet -- at the time, the largest collection of mineral specimens in the United States, and the only one that could compete with European collections -- to the college. But the limited subscriber base, and Bruce's own failing health, doomed the journal to a brief

[77] Archibald Bruce, "Introduction," *The American Mineralogical Journal*, Vol. 1 (Facsimile of the 1814 Edition). New York: Hafner Publishing Co., 1968; vii.

life. Three years after the last issue of 1814, Bruce still struggled to produce another number; he continued without success until 1817, when he was incapacitated by a stroke.

When a group of contributors realized the severity of Bruce's condition, they approached Silliman and urged him either to take over the journal or to start a new one in its place. Parker Cleaveland begged him to do so for the good of "our *little* band of mineralogists":

> You say that you are afraid, [that] Bruce's Journal is finally dead, and express a wish to have it *revived*. One thing is certain -- This Journal *must not* be discontinued -- the honor of our country and more especially the interests of mineralogy forbid....I know you will not object to the *labor* and *responsibility* when you take into consideration the importance of the object in view. Mineralogy cannot well flourish in this country without a regular and well conducted journal.[78]

After Silliman secured Bruce's blessing on the new venture, and received a commitment from Gibbs to help support it financially, he began to contact potential subscribers. By May of 1818, he had collected more than a hundred pages worth of articles, rounded up 412 subscribers, and found a printer.[79] Silliman published the first issue of *The American Journal of Science* in July of 1818.

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[78] Brown, 303.

[79] Brown, 305-6.

That first issue reflects the important lessons Silliman had learned from the failure of Bruce's journal. Bruce had appealed to American patriotism in the introduction to the premiere issue of *The American Mineralogical Journal*, but had done so in an understated fashion:

> The object of this work is to collect and record such information as may serve to elucidate the Mineralogy of the United States, than which there is no part of the habitable globe which presents to the mineralogist a richer or more extensive field for investigation.
>
> Of the utility of a publication of this kind, much might be said: it may however be sufficient to observe, that nothing has contributed more to increase and diffuse Mineralogical information than the periodical works on the continent of Europe, particularly those in Germany and France. At the present period, when such laudable exertions are making to improve and extend the manufactures of our own country, a knowledge of the mineral productions, on which so many of the useful arts depend, and with which nature has so liberally supplied us, becomes particularly desirable.[80]

While Bruce praised the rich resources of the nation and ascribed a patriotic purpose to his journal, his tone was dry, objective, and unemotional. Bruce's authorial position was

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[80] *The American Mineralogical Journal: Being a Collection of Facts and Observations Tending to Elucidate the Mineralogy and Geology of the United States of America*. New York: Jan 1810. Vol. 1, Iss. 1, xiii.

that of a scientist speaking to like-minded scientists; he stressed the importance of mineralogical work, but he did not try to bring it to the attention of a mainstream audience.[81]

Possessing a more flamboyant instinct for publicity than Bruce, Silliman sought to extend the readership of his journal beyond his fellow scientists. In almost Barnum-esque fashion, he announced his grand aspirations for *The American Journal of Science* in his "Introductory Remarks" to the first issue. There, he revealed that he intended to continue Bruce's mission of fostering an American scientific community, but hoped to expand its reach significantly by tying its professional communications to the popular cultural patriotism of the day. Like Jefferson before him, Silliman attempted to bring the emerging scientific community into dialogue with the larger cultural sphere, and he used patriotism as a point around which he could rally financial and intellectual support. Once his subscriber base was stable, he would use it to construct an empirical record of the nation's natural history that would contribute to the spread of the "culture of proof."

Silliman began his introduction to the first issue of the journal with a ringing challenge to his fellow citizens and scientists. After noting that Americans reaped "an

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[81] In subsequent issues, contributors rarely addressed the extra-scientific ramifications of their research, preferring instead to consider the localized subjects indicated in titles such as "Particulars relative to the Lead-Mine near Northampton, (Massachusetts.)," "Observations on the Mass of Iron from Louisiana," "Mineralogical Notice respecting Fluate of Lime from Virginia," and "On the deoxidation of Potash." These articles tended to describe mineralogical findings and scientific experiments in flat tones, and to give instructions to other scientists hoping to replicate their findings; they were, in other words, articles written for scientists, by scientists. Communications of this kind, of course, represent one of the central aims of any scientific publication, and mark the initiation of a system of scientific peer review in America. However, although Bruce's journal marked an important moment in the development of the "culture of proof" because it enabled scientists to pass along empirical information to one another, its small circulation restricted its influence. It presented scientific work in a cultural vacuum in which experimentation was hermetically sealed off from larger cultural events.

abundant harvest of information" from European scientific journals, Silliman asked, pointedly:

> But can we do nothing in return? ...we have no reason to shrink from a comparison with any country...and, not withstanding the local feelings nourished by our state sovereignties, and the rival claims of several of our larger cities, there is evidently a predisposition towards a concentration of effort, from which we may hope for the happiest results, with regard to the advancement of both the science and reputation of our country. [82] (I.i.2)

By aligning scientific progress with the advancement of the "reputation of our country," Silliman set forth an agenda that was more explicitly political than that of Bruce. An article submitted to the journal, in his formulation, was a contribution not only to scientific knowledge, but also to the very strength of the republic. Such work, Silliman implied, would force Europeans to acknowledge America's standing as an intellectual and scientific peer. It was, therefore, the patriotic duty of American scientists to read and contribute to his publication before European journals.

As Sillman's reference to "local feelings nourished by our state sovereignties" implies, his venture faced competition not only from foreign scientific journals, but also from regional publications within the United States. If he was to convince scientists to submit articles to his journal instead of to its local counterparts, he had to convince them to place the interests of the nation above the interests of their local scientific

[82] *American Journal of Science*, Vol. 1, No. 1 (1818), p. 2. Further citations to the journal will appear in the text.

communities. As a recent biographer of Silliman has noted, overcoming "local feelings" was not an easy task, since most scientific research of the time was disseminated through regionally based learned societies.[83] Whereas Bruce had routinely run excerpts of articles that had been published previously in the annals of learned organizations such as the American Philosophical Society, Silliman decided early on not to reprint locally published articles.

It was this ambitious step, more than any other, that was most responsible for the journal's role in fostering original American contributions to science. When the respected chemist Robert Hare offered him a previously published article, Silliman refused politely, replying that he wanted "to have some things appear *new born* in the only Journal of Science which this country possesses."[84] Silliman underscored the point by reminding his friend Hare of the importance of the journal's national scope:

> I will be perfectly frank with you as I have always been -- I say therefore -- publish your own productions in that form which will most promote your own views -- but foster my *arduous* -- may I not add my *national* undertaking -- for it has no local bearing -- with the same good will which I have ever shown to your interest & those of science at large....

Silliman's claim that the journal had "no local bearing" was slightly disingenuous, given the fact that many contributions described the types of natural resources that could be

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[83] Brown, 308.

[84] Brown, 309.

found in geographically specific locales. But Silliman did not mean to suggest that he was completely uninterested in local reports; rather, he recognized that local pieces, when printed in a journal with a national readership, helped create a representation of the United States that was akin to a patchwork quilt. By offering a national repository for new scientific work, Silliman helped knit together various local reports into a communal account of the nation's natural history and resources. A "Sketch of the Mineralogy and Geology of the Vicinity of Williams College, Williamstown, Mass," for example, which appeared in the fourth issue of the journal, did not in itself have an explicitly national scope. But when it was paired with pieces such as "On the Geology, Mineralogy, Scenery, and Curiosity of Parts of Virginia, Tennessee, and of the Alabama and Mississippi Territories," "Observations on the Minerals connected with the gneiss range of Litchfield County," and "Analysis of Harrodsburg Salts," empirical information about the full range of U.S. territories could be brought together to present a view of the nation that allowed previously unseen patterns in various parts of the country to be compared and contrasted.[85]

For this reason, Silliman, in his introduction, argued that, though "*This*, also, *may* perish in its infancy," his confidence in the venture was "derived from the obvious and intrinsic importance of the undertaking; from its being built upon permanent and momentous national interest...from assurances of support, in the way of contributions, from men of ability in many sections of the union; and from the existence of *such a crisis*

[85] In this sense, modern online publishing technologies have emulated Silliman's journal. RSS (Really Simple Syndication) feeds, which syndicate content from blogs, allow the work of disparate groups of writers to be drawn together on one website. Many sites feature aggregations of such feeds, thus creating central clearinghouses of information that bear resemblances to Silliman's national journal.

in the affairs of this country and of the world, as appears peculiarly auspicious to the success of every wise and good undertaking" (I.i.5). By aligning scientific progress with "permanent and momentous national interest," Silliman helped cement the connections between nationalism and science that Jefferson had forged in *Notes on the State of Virginia* and had burnished with his sponsorship of the Lewis and Clark expedition. Silliman's argument neatly tied the economic viability of his journal to the economic, political, and intellectual viability of the nation.

Silliman was, in fact, an ardent Federalist, so it is perhaps not surprising that his effort to create a national dialogue among scientists echoed the attempts of the nation's founders to cobble together diverse colonies into a workable national union. Silliman fully realized that he faced an uphill battle; unlike the colonial revolutionaries, supporters of his journal were not acting in response to the tyranny of an oppressive political regime. But, as he attempted to gather subscribers to his project, Silliman appealed to national pride, and claimed that his journal would play an important role in the destiny of the new republic:

> Is it not, therefore, desirable to furnish some rallying point, some object sufficiently interesting to be nurtured by common efforts, and thus to become the basis of an enduring common interest? To produce these efforts, and to excite this interest, nothing, perhaps, bids fairer than a SCIENTIFIC JOURNAL. (I.i.2)

While Silliman's nationalism was not unusual during a time of heated debates about the viability of the union, his suggestion that nothing "bids fairer" for "an enduring common interest" than a "SCIENTIFIC JOURNAL" was remarkable. Silliman seemed to suggest that a scientific journal could offer greater opportunities for cohesion than a federal government, a political party, a national bank, or a public newspaper, to name but a few other entities more commonly mentioned in such a context.

Although Silliman's claim could be dismissed as the promotional bombast of a canny editor attempting to pump up the circulation of a new journal, we would do well to remember the importance that Jefferson placed on scientific communities in *Notes on the State of Virginia*. As I have argued in Chapter 1, Jefferson felt that the communal project of science could provide a model for the social communities he hoped would flourish in the new republic. Silliman's promotion of the scientific journal as a tool of national cohesion is in line with that premise, though Silliman, in the above quotation, makes the point more emphatically than Jefferson did.

Was it realistic, in 1818, to suppose that a new scientific journal could foster the cohesion of a national union? Silliman had no doubt that it could. Critics such as Abbé Raynal had used America's lack of accomplished scientists to argue that the new country was inferior to European nations. It was in answer to this kind of argument that Jefferson, in *Notes on the State of Virginia*, had identified Benjamin Franklin and David Rittenhouse among the native geniuses that America had produced:

> ...America, though but a child of yesterday, has already given hopeful proofs of genius, as well of the nobler kinds, which arouse the best

> feelings of man, which call him into action, which substantiate his freedom, and conduct him to happiness....We therefore suppose, that this reproach is as unjust as it is unkind; and that, of the geniuses which adorn the present age, America contributes its fair share.[86]

As Jefferson's response to Raynal's criticism demonstrated, the progress of the sciences in America was tied to Enlightenment ideals of a knowledgeable and informed populace. If America's greatness could be inferred from the number of its geniuses and the merit of its scientific work, then a journal which elevated the quality of its scientific production would confer honor upon the Republic. It would also band American scientists into a common group united against European critics.

Just as the specter of European science cast the long shadow against which Jefferson boxed in *Notes on the State of Virginia*, the work of foreign scientists functioned in Silliman's introduction as both a model for American sciences to imitate and a threat to which they had to respond. As he made clear throughout the introduction, Silliman was troubled by the influx of European scientists who had come to America throughout the eighteenth century to gather specimens before returning home to report their findings in European journals. America's natural resources were literally being carried out of the country from under the noses of American scientists. To Silliman, it felt as if the honor of his nation was taken along with it.

Silliman was not anti-European by any means -- while training for his job at Yale, he had had traveled to England, Holland, and France, and learned much from scientific

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[86] Jefferson, *Notes*, 65.

authorities such as John Dalton, Friedrich Accum, and Humphry Davy. But now he complained that "Foreign naturalists are frequently exploring our territory; and, for the most part, convey to Europe the fruits of their researches, while but a small part of our own productions is examined and described by Americans: certainly, this is little to our credit, and still less to our advantage" (I.i.5). Silliman did not blame European scientists for this situation; rather, the problem had to do with American scientists -- or, rather, the lack of space in which they could publish their scientific findings. Although a "strong tendency...exists in this country towards the cultivation of physical science," he wrote, the "existing means for its effective promulgation" were inadequate. *The American Journal of Science* would help remedy that situation by giving American scientists a common organ through which they could construct a native professional community.

George Daniels has noted that one reason nineteenth-century American scientists issued such "declaration[s] of scientific independence from Europe" was that they hoped to increase governmental support for their burgeoning projects at a time when structured funding for scientific work was inconsistent, at best[87] Such pecuniary concerns helped guide American scientists towards research that would have practical uses in the marketplace. Even works of science that did not have obvious connections to the marketplace were put to practical use; Query III of Jefferson's *Notes on the State of Virginia*, for example, contained extensive information about which Virginia rivers were passable for trade, and the documentation he provided continued to be used by merchants decades after its publication.

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[87] Daniels, *American Science*, 46.

The practical nature of early American science has sometimes been seen as its defining quality; an emphasis on such work was readily evident in Silliman's journal: the very first volume of *The American Journal of Science* bore engravings of the design of Samuel Morley's steam engine, and the second number included an article by John L. Sullivan on the history and use of the engine. Sullivan took Silliman up on the subtitle of the journal (*The American Journal of Science, More Especially of Mineralogy, Geology, and the Other Branches of Natural History, Including Also Agriculture and the Ornamental As Well As Useful Arts*), noting that "Your Journal being the intended medium of information to promote the useful arts, I hope it may be consistent with this object to explain the manner in which these improvements may be made extensively useful" (I.ii.167). The article also extended the journal into the political realm when its author criticized politicians who had instituted a patent system that prevented inventors from reaping financial rewards from their creations.

American scientists appealed to the public for financing, but their emergent professionalism and specialization meant that their work was becoming increasingly inaccessible to lay audiences; they bridged that gap, in part, by emphasizing the practical utility of scientific inventions:

> The strategy was to link appeals to both the patriotism and the Democratic assumptions of Jacksonian America with appeals to the general utilitarian spirit of the age....Science was recommended to all who would hear as the highest example of useful knowledge. It was widely proclaimed that it would not only enrich and elevate the individual, but would make the

> nation great in both peace and war and advance mankind in general on the road to happiness for which it was destined.[88]

In Silliman's journal, contributors often touted "the useful arts," but such articles remained, by and large, separate from the more numerous, straightforward descriptions of scientific experiments. Silliman may have emphasized inventions that would prove useful to the general public, in other words, but he did not, as a rule, go so far as to suggest that all scientific work should be bent towards utilitarian goals.

In the fourth and final issue that was published at the end of the journal's first year, Sillman wrote a "Conclusion" summing up its progress. In it, he continued to link science to patriotism, but his ruminations took a decidedly darker turn from his optimistic introduction to the first issue of the journal:

> To concentrate American efforts in science and the arts, by furnishing a Journal to record their proceedings, will, in our view, not only have a direct influence in promoting the honor and prosperity of the nation as connected with its physical interests, but will also tend in no small degree to nourish an enlarged patriotism, by winning the public mind from the odious asperities of party. (I.iv.440)

[88] Daniels, *American Science*, 41-2.

"The odious asperities of party" was a reference to the divisive nature of American politics at a time when Jeffersonian one-party politics began to give way, towards the end of The Era of Good Feelings, to the discordant cacophony that would characterize the Jacksonian period.[89] Beset by a widespread depression after the Panic of 1819, Americans yearned for the patriotism and unity of earlier times that had seemed simpler and more unified. That Silliman saw his journal as an antidote to growing political discord -- that he felt that the drawing together of the American scientific community could heal the increasing rifts in the political fabric of the country -- shows how deeply he believed that the destiny of its country was tied to its scientific progress.

But Silliman's statement is also a stunning confirmation of Jefferson's notion that the communal project of science could serve as a model for citizenship in the new republic. In fact, Silliman took Jefferson's notion one step further, suggesting explicitly that the ills plaguing American political life could be salved by American scientific communities. In this way, Silliman reinforced his opening statement, in the first issue of the journal, that "to furnish some rallying point, some object sufficiently interesting to be nurtured by common efforts, and thus to become the basis of an enduring common interest . . . nothing, perhaps, bids fairer than a SCIENTIFIC JOURNAL" (I.i.2).

[89] I am grateful to William P. Kelly for his helpful reading of this statement.

The Empirical Basis of the Culture of Proof

The historian John C. Greene has called Benjamin Silliman a "transitional figure, linking the science of the Jeffersonian era with that of the Jacksonian."[90] Silliman came into maturity during Jefferson's presidency and achieved prominence in the Jackson era. Despite his federalist leanings, Silliman's scientific values reflected the principles of Jacksonian democracy. Andrew Jackson was viewed as a "man of the people" by his supporters, and "King Mob" by detractors who worried that his presidency would erode the established interests of the aristocracy.[91] Making a name for himself not through his lineage or his political connections, but through military exploits such as the Battle of New Orleans, Jackson famously embodied the age of "the common man."

Silliman's journal, with its broad audience of scientists and scientifically minded laymen, helped create an accessible national dialogue about science. The idea that good science should be grounded in empirical evidence united the audience of the journal. As contributors from various parts of the nation submitted articles, letters, reviews, and notes to the journal, they supported their findings with facts, figures, and diagrams, helping to build an empirical record of the nation. In this sense, the journal came to embody the common bond -- the land itself -- that unified Americans.

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[90] John C. Greene, *American Science in the Age of Jackson*. Ames: Iowa State Press, 1984; 244.

[91] Arthur C. Schlesinger, *The Age of Jackson*. New York: Little, Brown & Company, 1945; 6.

In his "Introductory Remarks" to the first issue of the journal, Silliman set the tone for the type of scientific work he expected from his contributors. Perhaps not surprisingly, Silliman's strongest statements on the importance of empiricism appeared in his discussion of geology -- the same branch of science that spurred Jefferson to wrestle with the importance of empirical evidence in *Notes on the State of Virginia*. Silliman's introduction, which discusses, in turn, the state of various branches of American science, moves in a more general direction when he reaches the subject of geology. Surveying the history of the discipline, Silliman diagnoses a methodological problem that has plagued it, and suggests that recent work has begun to correct that error:

> To account for the formation and changes of our globe, by excursions of the imagination, often splendid and imposing, but usually visionary, and almost always baseless, was, till within half a century, the business of geological speculations; but this research has now assumed a more sober character; the science of geology has been reared upon numerous and accurate observations of *facts*; and standing thus upon the basis of induction, it is entitled to rank among those sciences which Lord Bacon's Philosophy has contributed to create. (I.i.6-7)

Examples of such speculative "excursions of the imagination" in the mid-eighteenth century included Count de Buffon's theory that the earth had been formed by material shorn from the sun by a comet and Benjamin Franklin's proposition that geological shifts

were caused by a ball of highly condensed air at the center of the planet.[92] By the early nineteenth century, as Silliman points out, such arguments had been supplanted by theories of "a more sober character" that had "been reared upon numerous and accurate observations of *facts*." And yet, as exemplified by Jefferson's discussion of marine shell fossils found at the top of an Appalachian mountain, examinations of empirical evidence could still yield widely divergent interpretations of natural phenomenon.

Both sides of the most heated geological debate in the late eighteenth century, for instance, based their arguments on empirical facts. The "Wernerians," also know as the "Neptunists," were led by the Abraham Werner and his disciples. Werner, a mineralogist who had proposed a new method of identifying and classifying minerals based on their external appearances, believed that the earth's features had been formed by a universal flood, described in the bible, that left behind sedimentary rocks and deposits as water slowly drained back into the oceans. Chandos Michael Brown notes:

> As it was propounded in Edinburgh, Werner's system maintained that the geological structure of the earth was formed almost at once through the agency of the universal ocean. The purpose of geology, then, was to study the signature of that primary event and, secondarily, to consider the comparatively diminutive effects of the subsequent natural forces of erosion, deposition, and vulcanism. In Wernerian terms, the history of the

[92] Greene, 218.

> earth was mainly static: the catastrophic sequence of events were correspondingly trivial.[93]

Still, in the years after he first proposed his theory, Werner was forced to adjust it several times to account for newly discovered fossil evidence that revealed organic remains in primitive sedimentary deposits; such fossils suggested that organic life had existed long before the flood he described, and indicated that the earth was far older than he had proposed. In response, Werner hypothesized that multiple floods could have occurred or that large storms could have been responsible for renewed flooding.[94]

The "Huttonians," also known as the "Plutonists," opposed Werner's theories, and based their opposition upon empirical facts. Led by the geologist James Hutton, who had proposed a dissenting theory of the earth's origins in *Theory of the Earth with Proofs and Illustrations* (1795), the Plutonists argued that "the present is the key to the past" -- that the natural forces affecting the shape of the earth in the present time were the only forces that had shaped it in the past.[95] Erosion, heat, and pressure, rather than a biblical-era flood, had chiseled the features of the earth over a seemingly limitless amount of geological time. Hutton analyzed rock beds that contained horizontal layers of deposited stone, which had been ruptured by bursts of molten lava and then eroded by other forces;

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[93] Brown, 191.
[94] Greene, 220.

[95] Mott Greene, *Geology in the Nineteenth Century: Changing Views of a Changing World*. Ithaca: Cornell U.P., 1982; 19.

more than his contemporaries, he recognized the important role played by the internal heat of the earth in its continuous physical transformation.[96]

Despite Hutton's opposition to the Neptunist argument that biblical floods had shaped the earth, it would be wrong to assume that Hutton's propositions did not assign divine agency to geological change. On the contrary, scholar Mott Greene argues that Hutton's early experience as a gentleman farmer inflected his scientific views with religious undertones:

> . . . the source of his early interest in geology was his concern to understand how new soil might be created to replenish exhausted and overworked land. His conclusion was that the erosion cycle, superficially destructive, was the divine solution to the problem. The Lord, in His infinite wisdom, ordained that the land should be worn away and carried to the sea, where new land could be created and later raised above the waters. The gradual erosion of the rocks, endlessly repeated, created a constant soil bank; the system of the world was self-renewing. (23)

Hutton's formative experience as a farmer led him to see cycles of movement in the natural system where others saw only cataclysmic events. However, despite Hutton's deistic belief that God had set in motion the cyclical natural processes that shaped the earth, opponents such as the Irish mineralogist and chemist Richard Kirwan attacked him for disputing the biblical account of creation. Hutton's dense prose sometimes obscured

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[96] Greene, *Geology*, 19-20.

the religious underpinnings of his theories, and his detractors responded more often to second-hand explanations of his work, such as those provided by John Playfair and Charles Lyell, than to what he actually wrote.

Benjamin Silliman studied at Edinburgh -- the epicenter of the Werner-Hutton geological debate -- in the winter months of 1805-6. As he put it in his *Reminiscences*,[97] "my residence in Edinburgh occurred at the fortunate crisis, when the combatants on both sides were in the field; and I, although a non-combatant, was within the wind of battle, and prepared, like victory, to join the strongest side" (169). While there, he strove to find a compromise position, believing that "both theories were founded in truth" (170). He agreed with the Huttonians, for instance, that various kinds of rocks were not formed by water, but his religious convictions, as well as his aesthetic appreciation of Werner's theory,[98] left him unable to accept Hutton's expanded sense of geological time and the disputation of biblical accounts of creation that it implied. In his *Reminiscences*, Silliman writes first that "as far as I had any leaning, it was towards the Wernerian side." Later, he writes that "I became, therefore, to a certain extent, a Huttonian . . . [but] remained as much of a Wernerian as ever." Finally, he concludes by writing "But I held myself aloof

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[97] George Fisher, *Life of Benjamin Silliman, M.D., LL.D.* New York: Charles Scribner and Company, 1866. This text contains verbatim biographical reminiscences written by Silliman; I will refer to it as Silliman's *Reminiscences* in the text. In so doing, I follow the example of Silliman's latest biographer, Chandos Michael Brown. In the Preface to his book, Fisher writes: "Professor Silliman, after he had retired from active duty in College, spent considerable time, at the request of members of his family, in writing down reminiscences of his life. . . . In undertaking, by the invitation of his family, to prepare a Memoir of my venerated friend, it appeared to me that the work should be, as far as practicable, in his own words; that extracts from the Reminiscences, and when they terminate, from the Diary, should furnish the basis of it. . . ." (v).

[98] Brown, 190.

from entire committal to either theory, or to any theory except one derived directly from the facts."[99]

Silliman's biographer, Chandos Michael Brown, suggests that Silliman declined to endorse either school of thought fully because his "aims were utilitarian: to develop a system for teaching these sciences in America . . . he could exercise a tourist's prerogative and pick and choose what most suited his purpose or what least offended his sensibility."[100] Silliman's reluctance to become a card-carrying Huttonian or Wernerian reveals much about his character as a scientist: he was cautious; he was willing to listen to and consider all sides of a debate; and he expected a case to be won or lost based on its adherence to factual evidence. All of these qualities were what made him a good editor for what would become America's most important scientific journal in the nineteenth century.

Silliman's characterization of geology in the first issue of his journal, as a science that "has been reared upon numerous and accurate observations of *facts*," in contrast to earlier "excursions of the imagination," was both a description and a prescription for American geology. Silliman continued his introduction by arguing that geology in America was "now prosecuted by actually exploring the structure and arrangement of districts, countries, and continents."

From his position at *The American Journal of Science*, Silliman was in a good position to encourage that kind of work, and to help establish empiricism as the

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[99] Benjamin Silliman to Mary Noyes, Edinburg, Feb. 27, 1806, Silliman Correspondence, Beinecke Library, Yale University. Quoted in Greene, 220.

[100] Brown, 192.

foundation upon which future American work in geology would be built. In the early issues of the journal, Silliman emphasized repeatedly the importance of empirical evidence. Two book reviews in the first issue of the journal, for instance, lauded authors for their empirical methods. Cuvier's *Essay on the Theory of the Earth* was praised for "secur[ing] the understanding by a strict course of reasoning from facts," while Amos Eaton's *Index to the Geology of the Northern States* was complimented as an "extensive collection of facts." Such praise implied that scientists wishing to receive similarly positive reviews would be wise to mimic the methodologies of the texts under review.

In remarks written to introduce a letter from the geologist William Maclure that appeared in the journal, Silliman re-emphasized that "Geology, at the present day, means not a merely theoretical and usually a visionary and baseless speculation, concerning the origin of the globe; but, on the contrary, the *result* of *actual examination into the nature, structure, and arrangement of the materials of which it is composed*" (I.iii.209-10). These sentiments closely echoed those Silliman had expressed in his introduction to the first issue, even recycling some of the same keywords ("visionary," "baseless," "speculation").[101]

Other contributors to the journal picked up on this theme and encouraged fellow scientists to reason strictly from facts. In an article titled "On the Prairies and Barrens of the West," an author named A. Bourne commented upon the theory of a Mr. Atwater,

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[101] As noted earlier in this chapter, Silliman had written the following in that Introduction: "To account for the formation and changes of our globe, by excursions of the imagination, often splendid and imposing, but usually visionary, and almost always baseless, was, till within half a century, the business of geological speculations; but this research has now assumed a more sober character; the science of geology has been reared upon numerous and accurate observations of *facts*; and standing thus upon the basis of induction, it is entitled to rank among those sciences which Lord Bacon's Philosophy has contributed to create. (I.i.6-7)

who had proposed that the Erie and Michigan lakes at one point flowed into the Ohio and Mississippi rivers. As he offered his reasons for opposing that theory, Bourne cautioned his fellow scientists to rein in their theoretical impulses:

> Our citizens express a great anxiety to become the founders of new systems and theories to account for the surprising phenomena which they discover in the structure of the western country. But perhaps it would advance the progress of science and general knowledge as much, to examine facts carefully, and report them to posterity faithfully, without bending and twisting them to prop up imperfect theories. (II.1.34)

Bourne contends that scientists should not necessarily work to formulate new theories, which could lead them to bend and twists facts to fit them, but rather to perform the act of gathering and preserving the available evidence so that future generations would be able to parse them correctly.

It is important to note, however, that Bourne refers not to "scientists," but to "citizens." This linguistic shift suggests that even as the sciences became professionalized, and as scientific education became centralized around universities, the task of empirical fact-gathering became one of the civic duties of American life. This would seem to confirm Silliman's contention that a scientific journal could serve as a "rallying point, [an] object sufficiently interesting to be nurtured by common efforts, and thus to become the basis of an enduring common interest." Thanks in part to Silliman's

journal, science began to move into the realm of popular culture, and it carried the empirical methodology of the "culture of proof" along with it.

As *The American Journal of Science* grew, so too did the sense that America was a nation of fact-gatherers. With readers and contributors from increasingly scattered parts of the country, the journal served as a repository for exactly the kind of collection of facts that Bourne advocated. Along with their articles, contributors to the journal often mailed Silliman samples of the rocks, plants, and specimens that they discussed. A typical example appeared in a letter to the editor from James Pierce of New York, who began his contribution by writing, "I forward to you a few mineral specimens characteristic of Staten Island, including native carbonate of magnesia, in acicular crystals" (I.ii.142). Another article began with the statement, "I forward you specimens of straw and rose-coloured amianthus" (I.i.54). A third scientist mentioned "a set of specimens taken from the different basaltic walls in this neighborhood, illustrative of their formation," and promised that "you will probably receive them shortly by one of the coasting vessels from Wilmingham to New-York" (V.i.9).

Such statements did not necessarily have to appear in the published articles; Silliman could have easily removed them before printing them. That he included them suggests that such statements served a rhetorical purpose; they showed that the editor of the journal had received empirical proof of the facts related in the article, and that such proof had, in his judgment, supported the claims of the article. Silliman, in many ways, became the gatekeeper of the scientific discipline taking shape in the pages of his journal; his readers knew that articles had met with his editorial approval, and furthermore, that they had been supported by empirical evidence that Silliman had also sanctioned.

In time, *The American Journal of Science* became known simply as "Silliman's Journal." This yoking together of Silliman's editorial personality with a journal that became a collective empirical record of the nation suggests a possible reinterpretation of the ways in which periodical literature shaped American identity. In *The Letters of the Republic*, Michael Warner argues that, through the rise of local newspapers in the early republic, "the public was constructed on the basis of its metonymic embodiment in printed artifacts."[102] This constructed public was fundamentally abstract:

> Pamphlets and broadsides were a familiar and normal feature of politics. In their routine dispersion, and in the conventions of discourse that allowed them to be political in a special way, these artifacts represented the material reality of an abstract public: a *res publica* of letters. . . . Unlike the public of the customary order, which was always incarnated in any relation between persons and which found its highest expression in church and town meetings, **the public of print discourse was an abstract public never localizable in any relation between persons**. By the same token, print became publication in a newly privileged way, since it was only in print discourse that one could make things public for the now abstract public. (61-2, emphasis added)

The early years of *The American Journal of Science* suggest the degree to which "the public of print discourse" had changed by the 1820s. Unlike many political tracts, the

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[102] Michael Warner, *The Letters of the Republic: Publication and the Public Sphere in Eighteenth-Century America*. Cambridge, Mass.: Harvard U.P., 1990; 61.

journal emphasized authorial identity, and items printed without attribution were assumed to have been written by Silliman himself. Silliman's personal authority was the basis upon which the journal was built; and, in addition to sending him evidence of the materials they discussed in their articles, authors sometimes addressed him directly, beginning their pieces with salutations such as "To the Editor of the American Journal of Science" or "Dear Sir."

Like the print objects Warner describes, then, *The American Journal of Science* did create an abstract *res publica* in print; but it was built upon the twin pillars of empirical proof and Silliman's editorial persona. His editorial voice was built into the journal from the very beginning. Unlike Archibald Bruce, whose introductory letter to the Mineralogical Journal had been impersonal, Silliman tended to engage his readers directly, as if he were addressing each one on a personal level.

To suggest that *The American Journal of Science* was built upon less abstract terms than many publications of its time is not to dispute the overall implication of Warner's claim. For indeed, the journal did begin to embody not only American science, but also the American landscape itself. In the early years of the journal, contributors from disparate parts of the country wrote detailed descriptions of the types of natural phenomena that could be found in various states, towns, and neighborhoods. Many articles did not argue scientific hypotheses or detail scientific experiments; rather, they simply catalogued natural phenomena, presented dated calendars of natural events, and described the different times of year at which various changes in the environment could be observed. C.S. Rafinesque, for instance, published "Journal of the Progress of Vegetation, &c." in the first issue of the journal. This calendar of events presented "an

accurate journal" of the dates and times that various vegetation had bloomed in Philadelphia in 1816. Rafinesque described natural events with a flair that seemed to presage Walt Whitman's later poetical catalogues:

> March 11. Seen the first spider, in the country, brown, oblong, walking. A fall of snow at night.
>
> [...]15. The *Populus fastigiata*, Lombardy poplar, begins to show its catkins.
>
> 17. The big-eye herring (*Clupea megalops*) begin to be seen at the fish-market.
>
> [...] 24. *Populus fastigiata*, and *Salix caprea*, are in full bloom -- The gooseberry bushes shoot their leaves. (I.i.79)

Such botanical calendars were not uncommon at the time, but in the pages of a scientific journal devoted to a range of sciences across a range of locales, they took on a new cast: they became part of the quilt of empirical description that detailed the full diversity of American natural history on the printed page.

Many articles simply contained descriptions of various plants, fauna, and minerals; presumably, such descriptions would be of use to both scientists in those local communities, and to scientists across the country, who sought to gain fuller understanding of the range of natural resources across the country as a whole. In the third issue of the journal, for instance, F.C. Schaeffer wrote:

> It is desirable that some mode should be adopted by which the public may become acquainted with all the *New American Localities of Minerals*, as they are discovered from time to time. With deference I would suggest, that in each number of your Scientific Journal, new localities might be recorded in alphabetical order, for present information and future reference. (I.3.236)

Schaeffer's words show that from the inception of the journal, contributors to it had the sense that they were collectively building a national archive of scientific information for both "present information and future reference." Though they knew that their contributions would help other naturalists exploring the continent in their own time, scientists saw *The American Journal of Science* as a permanent repository in which an empirical record of the country could be preserved.

Such local descriptions were not limited to botany. Geologists often described their forays through the American landscape, remarking upon various features and curiosities that they met along the way. Several articles in this vein seemed to echo Jefferson's *Notes on the State of Virginia*. In the first issue of the journal, for instance, "Mr. John H. Kain, of Tennessee," wrote "Remarks on the Mineralogy and Geology of the Northwestern part of the State of Virginia, and the Eastern part of the State of Tennessee." He wrote:

> Occasionally we are presented with a view of a sublime precipice, formed by a section which a river appears to have made for itself through an

> opposing mountain; and the large masses of ruins, which lie scattered around such a place, seem, to the imagination of the solitary traveler, the historical records of commotions, awful even in retrospect. (I.i.60)

This passage echoes Jefferson's reflections on the path of the Potomac river through the Blue Ridge mountains, in which he speculated upon the "violent convulsion" that must have altered the face of the mountain "from what it probably was some centuries ago" (198).

Another article that appeared in an early issue of the journal echoed Jefferson's work more directly. In an essay titled "On the Geology, Mineralogy, Scenery, and Curiosities of Parts of Virginia, Tennessee, and of the Alabama and Mississippi Territories, &c. with Miscellaneous Remarks, &c," the Reverend Elias Cornelius described an encounter with the Natural Bridge in Virginia. Although, at the outset of the article, Cornelius claimed that "my object in naming this celebrated curiosity, is not to give a new description of it, but merely to furnish a correct account of its dimensions," he quickly moved from an analysis of its size to a description of the sublime that conspicuously echoed Jefferson's work. Jefferson had famously described the "violent head ache" that the view had produced, and wrote that "it is impossible for the emotions, arising from the sublime, to be felt beyond what they are here: so beautiful an arch, so elevated, so light, and springing, as it were, up to heaven, the rapture of the Spectator is really indiscribable!" (25). Cornelius' account of the same viewing experience was figured not as a personal experience, but rather as a kind of scientific experiment. He wrote that "the following anecdote will evince the effect which the sight of the natural

bridge produced on a servant, who, without having received any definite or adequate ideas of what he was to see, attended his master to this spot."

In contrast to Jefferson, Cornelius described a rapturous view from the bridge not from the top, but from below. In fact, he undercut Jefferson's account in some ways by explaining that "from the top of the Bridge, the view is not more awful than that which is seen from the brink of a hundred other precipices":

> The grand prospect is from below. To reach it you must descend the hill by a blind path, which winds through a thicket of trees, and terminates at the instant when the whole bridge with its broad sides and lofty arch, all of solid rock, appears perfectly in sight. Not one in a thousand can forbear to make an involuntary pause : but the servant, who had hitherto followed his master, without meeting with any thing particularly to arrest his attention, had no sooner arrived at this point, and caught a glance of the object which burst upon his vision, than he fell upon his knees, fixed in wonder and admiration. (I.iii.319-20)

This account both buttresses and subverts Jefferson's account. Like Jefferson, who wrote that "you involuntarily fall on your hands and feet, creep to the parapet and peep over it," the servant collapses before the sublime spectacle. Whereas Jefferson's view was from the top-down, however, Cornelius' described the view from the bottom-up, in both a physical sense and a sociological one. For instead of the vision of Virginia gentleman prostrate in front of the natural sublime, Cornelius described the reaction of a servant.

This servant, deprived of Jefferson's enlightened knowledge, approaches the bridge without preformed judgment or expectation; his position as one who was without "any definite or adequate ideas of what he was to see" figures him, in certain ways, as the ideal subject for Cornelius' experiment. Cornelius' vassal is an empty vessel, a blank slate upon which the wonder produced by the natural bridge could be recorded. Cornelius found that the servant's reaction confirmed his hypothesis that the bridge "proceeded from the hand of the Almighty, as it is; for great and marvellous are all his works!" (I.iii.319)

In many ways, the differences between Jefferson's and Cornelius' accounts of the Natural Bridge encapsulates the drive for empirical knowledge that came to dominate the pages of *The American Journal of Science*. For Jefferson, the power of the bridge was best conveyed by a top-down approach, by describing the reaction of an enlightened man of knowledge to the raw power of nature. For Cornelius, the bridge was best viewed from the bottom-up by a man with no preconceptions, a man whose impressions were formed completely and empirically by the sights in front of his eyes. Cornelius transforms the servant himself into the kind of objective recording instrument that had properties which would later be associated with the photographic camera -- a neutral apparatus whose vision was unclouded by passion or prejudice, a blank plate whose surface could be read as a sublime spectacle made a lasting impression upon it.

Cornelius' attempt to render the scene at the Natural Bridge prefigured the ways in which later scientists would use the camera. Putting aside the obvious racism inherent in Cornelius' treatment of his servant, we see that he attempted to use the servant's reaction to the scene as evidence of the power of the bridge. This example shows that a

growing desire for proof emerged in the American scientific community in the years before the invention of photography. As scientists sought to convey the results of their experiments to an ever-growing readership in the pages of *The American Journal of Science*, they groped for new and objective ways to record and present their data. In 1818, such an objective instrument took the form of a servant whose sense impressions could be read upon his facial features; after 1839, scientists could rely on mechanical cameras to provide seemingly objective views of the scenes they described. Only by presenting the facts of experience could scientists complete the picture of nature that they found in the American landscape.[103]

Financial Struggles

The national scope of the *American Journal of Science* was its most ambitious characteristic, and it remains the reason why the journal continues to be studied today (rather than for the specific studies published in its pages). But the *Journal* faced many obstacles on the road to success. It was not until the 1830s that advances in papermaking, the cylinder press, postal routes, and railroad distribution helped create a national periodical market.[104] In the early years of the journal, Silliman was forced to create his

[103] As Alan Trachtenberg points out in his discussion of the daguerreotypes Louis Agassiz had made of African-born slaves in South Carolina, it did not take long for servants to become subjects of the photographic gaze. Trachtenberg, *RAP*, 53-55.
[104] *Periodical Literature in Nineteenth-Century America*, ed. Kenneth M. Price and Susan Belasco Smith. Charlottesville: U. of Virginia P., 1995; 3.

own system of distribution. In order to build sales, Silliman relied on a self-built system of contacts throughout the country who found subscribers in their local communities.

In a conclusion written at the end of the journal's first year of publication, Silliman noted proudly that the journal had exceeded its promised number of pages and issues, and had even included "twelve copper-plate engravings and several woodcuts." But Silliman paired this reminder of the journal's fulfillment of its responsibilities to readers with a chiding notice about the readers' responsibility to it:

> In justice to the publishers of this work, we add, that *this publication is an expensive one;* very heavy advances have been already made by them, while only a trivial amount has been received in return. It is hoped, therefore, that subscribers will promptly remit, *free from postage*, the small stipulated sum, and also make the required advance for the succeeding volume. . . . In a subscription so widely dispersed over a large portion of the United States, an inattention to *punctual payment* must soon put in hazard the existence of a work, having otherwise the fairest prospect of continuance, and we hope of usefulness. (I.iv. 441)

As Silliman noted in the following paragraph, the appearance of future volumes of the journal was dependent on whether or not "*the public be willing to pay for the work*."

Indeed, it was the case that more people were willing to subscribe to the journal than were willing to pay for it when the bill arrived. This had to do partly with the fact

that the journal often arrived late -- if at all -- because of problems with the mail. The United States Postal Service would deliver bound periodicals, but it charged exorbitant prices for delivery, which forced Silliman to rely on commercial carriers who often proved untrustworthy[105]. As Chandros Michael Brown has pointed out, "an audience for science existed, and authors were willing to contribute and booksellers ready to sell, but Silliman could not get the *Journal* to its subscribers."[106] This was especially true during the first few years of the journal's existence.

Silliman's distribution problems were compounded by the fact that there were few models for him to follow: most American periodicals at the time operated on a local level, and were rarely distributed to areas that were more than a few days' journey from their point of origin.[107] Most learned societies were locally organized, too, and their members were more likely to submit their work to their nearby peers than to commit to the vagaries of a national distribution process.

Silliman might not have been able to overcome these distribution challenges without the help of benefactor Colonel George Gibbs. Gibbs, who had amassed one of America's most spectacular cabinets of natural specimens and donated it to Yale, enabled Silliman to offer the first American course in mineralogy and geology that could be

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[105] Brown, 308.

[106] Brown, 308.

[107] Brown, 308.

copiously illustrated with specimens.[108] Gibbs' staunch financial support of Silliman's journal helped ensure that the publishing venture would survive its early growing pains.

But even with Gibbs' support, Silliman was forced to remind readers repeatedly that they needed to support the journal by subscribing to it and paying their bills on time. Whereas he had previously emphasized the cost of producing the journal in his editorial notes, he took a different tack in later years. In November, 1820, at the end of the journal's second year, Silliman echoed his introduction to the first issue of the journal by appealing to nationalism and patriotism:

> As two volumes of this work are now completed, the public are in a situation to judge how far the execution has corresponded with the original plan. Not a *local*, but a *national* undertaking, its leading object is to advance the interests of this rising empire, by exciting and concentrating original American effort, both in the sciences, and in the arts, and it may with truth be said, that no Journal was ever more fully sustained by *original* contributions. They have been forwarded from our cities, towns and villages . . . from the East and the West, the North and the South . . . so that the Editor feels himself justified in believing, that this work is regarded as a *national Journal*. (2.ii.i)

Emphasizing his editorial decision to print original articles, rather than material which had already appeared in local or foreign journals, Silliman rightly pointed out that his

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[108] Robert V. Bruce, *The Launching of Modern American Science*. New York: Alfred A. Knopf, 1987, 15.

publication widened the scope and increased the depth of American science. Again, he emphasized the role the journal played in creating a national, rather than a local, dialogue; and he argued that such communication was in "the interests of this rising empire."

After describing the service that the Journal had done for the country it represented, Silliman began to argue the converse proposition -- that the nation was obliged to do service for it:

> The Editor, although called upon to sustain the *pecuniary*, as well as the more *appropriate* responsibilities of the work, is determined not lightly to abandon the undertaking. He will persevere, until it is ascertained, whether the vast American Republic, with ten millions of inhabitants, with wealth scarcely surpassed by that of the most favoured nations, and with immensely diversified interests, growing out of those physical resources, which the bounty of God has given us, will permit this effort, devoted to the advancement of its wealth and its power, its honor and its dignity, to become abortive, with the gloomy presage that it *may be very long* before any similar enterprize can be successfully prosecuted. (II.2.i)

Silliman could not have set the stakes for his journal in starker relief: his publication -- devoted, in this formulation, not to science, but to "the advancement [of America's] wealth and power" -- was a boon to the international reputation of the United States; if America hoped to become a major power -- if it hoped to become Europe's equal -- it

would have to support its scientific journals. In 1820, the fate of the journal remained uncertain.

Two years later, in 1822, Silliman declared in a preface to volume five of the journal that the issue had been decided in the journal's favor: thanks to support from its readers, *The American Journal of Science* would survive:

> A trial of four years has decided the point, that the American Public will support this Journal. Its pecuniary patronage is now such, that although not a lucrative, it is no longer a hazardous enterprize. (V.i.i)

With the financial health of the journal assured, Silliman noted that "the intellectual resources of the country are sufficient to afford an unfailing supply of valuable original communications." In this respect, the journal had succeeded in its goals: it had become the primary vehicle through which an American scientific community would be built.

Broadening the Audience

In his conclusion to the first volume of the journal, Silliman emphasized that *The American Journal of Science* sought contributions not only on scientific topics, but also on artistic ones:

> If we may be allowed to express a wish relative to the nature of future communications, it would be, that those of a scientific nature should not be diminished, while those relating to the arts, to agriculture, and to domestic economy, should be increased; we particularly solicit the communications of practical men, versed in the use and ornamental arts, **and they will be acceptable should they not even be clothed in scientific dress.**" (I.iv. 441, emphasis added)

From the very first issue of the journal, Silliman had attempted to tie his publication to the arts. Indeed, the full title of the journal was "The American Journal of Science, More Especially of Mineralogy, Geology, and the Other Branches of Natural History; Including Also Agriculture and the Ornamental as well as Useful Arts." One motivation for including articles on subjects other than science was surely financial: enlarging the scope of the journal to include the arts helped Silliman broaden the scope -- and, therefore, the subscription base -- of his publication.

Silliman hoped that his journal would be of interest not only to scientists, but also to the larger American community. The inclusion of the "Useful Arts" played to the pragmatic nature of American experimenters in the mold of Benjamin Franklin, who sought to invent and tinker with new technologies. And so, *The American Journal of Science* included articles on topics as diverse as "Augmenting the Force of Gunpowder," "On a new Lamp, without Flame," and "Notice of Col. Trumbell's Picture of the Declaration of Independence." At the same time, Silliman was wary of including too

much art-related content, and strove to keep most of the journal scientifically based. Silliman was "not inclined to renew the abortive experiment, to please everybody," but the precarious financial circumstances of the journal did force him to try to broaden the appeal of the journal as much as possible.

In his "Plan of the Work," Silliman wrote that "While Science will be cherished *for its own sake*, and with a due respect for its own *inherent* dignity; it will also be employed as the *handmaid to the Arts*."[109] The list of artistic subjects upon which Silliman proclaimed himself willing to accept contributions included Music, Sculpture, Engraving, and Painting (I.1.vi). And indeed, the very first article in the first issue of the journal was "An Essay on Musical Temperament, by Professor Alex. M. Fisher." If the prospect of such an article upon an artistic subject conjures, to the modern reader, thoughts of a light and breezy introduction to the raptures of musical appreciation, it should be noted that Professor Fisher's contribution was a rather technical study of scales. Included within it, for example, was a table displaying "the ratio of the whole number of times which the different chords would occur, were the 1600 scores, whose signatures were examined, actually played in succession, on the keys to which they are set, and with an instrument having distinct sounds for all the flats and sharps" (I,i.34-35). In a later continuation of the same article, Fisher's "Essay on Musical Temperament" included insights such as this:

> Applying this principle to the system of temperament in Prop. III, which flattens all the concords, it is plain that raising any given degree by *x* will

[109] *The American Journal of Science*, Vol. 1, No. 1 (1818); v. Further references to the journal will appear in the text with volume, number, year, and page noted.

> increase the temperaments of the concords above that degree, and diminish those of the concords below it. Hence it ought to be raised till ($m - x$) a + ($n - x$) + ($p - x$) c = ($m' + x$)a + ($n' + x$)b + ($p + x$)c' : from which x is found
>
> $$= \frac{am - a'm + bn + b'n' + cp - c'p'}{a + a' + b + b' + c + c'}$$

Such remarks were, apparently, somewhat controversial, as an 1820 response to Fisher's piece attests.[110]

The journal did publish a few examples of more widely accessible fine-arts articles. One set of articles attempted the somewhat dubious task of rendering scientific information in poetic form. In a set of stanzas entitled "Geological Cookery," for example, an unnamed author wrote out directions for creating various sorts of hybrid stones:

> *To Make Granite.*
>
> Of Felspar and Quartz a large quantity take,
>
> Then pepper with Mica, and mix up and bake.
>
> This Granite for common occasions is good;
>
> But, on Saint-days and Sundays, be it understood,

[110] The later article appeared in 1820 (II.i), and was titled "On different modes of expressing the magnitudes and relations of Musical Intervals, with some remarks, in commendation of Professor Fisher's proportionally tempered Douzeauve, by Mr. John Frarey, senior."

If with bishops and lords in the state room you dine,
Then sprinkle with Topaz, or else Tourmaline.

N.B. The proportion of the ingredients may be varied *ad libitum*; -- it will keep a long time. (V.2.284)

Perhaps marking the first and last time that "Tourmaline" was utilized as an end-rhyme, this poem deploys a sense of humor that was rarely displayed in the pages of the usually serious scientific journal. Its attempt to marry poesy to hard science through the conceit of cookery is perhaps best displayed by the poet's directions for what to do with the "leftovers":

To make Pudding-stone

To vary your dishes, and shun any waste,
Should you have any left of the very same paste,
You may make a plum-pudding; but then do not stint
The quantum of Pebbles -- Chert, Jasper, or Flint. (V.2.284)

While they were certainly jovial, these poems were not written in jest -- the author footnoted his stanzas with technical remarks, such as "The geological Neophyte who attempts to make aggregated rocks from the above approved receipts, should attend to the following directions: -- Granite rocks must be composed of crystalline grains of two or more different species of minerals closely united without any cement...." Such footnotes

show that while the author clearly sought to amuse his audience, he also expected his fellow geologists to use his "recipes" in their laboratories. Although Silliman had decided not to reprint scientific work, these poems had been published previously; Silliman's decision to republish scientific doggerel shows how strongly he wanted scientific ideas to enter mainstream culture.

Although the journal continued to cover the arts in subsequent issues, Silliman pushed that coverage further and further back in its pages. Whereas the article on musical temperament led the first issue of *The American Journal of Science*, Silliman moved such articles toward the ends of later issues, where they appeared alongside "Miscellany" and "Foreign Correspondences." Silliman remained committed to publishing articles on the arts throughout the twenty years that he edited the journal, but perhaps he realized, after a time, that his core subscribers were more attuned to the scientific aspects of the journal than to its arts coverage.

In a few articles, Silliman mixed an appreciation for art with the nationalistic sentiments that drove him to create the journal in the first place. One such article was "Notice of Colonel Trumbell's Picture of the Declaration of Independence" (I, 2, 200-203), which was presumably written by Silliman himself (there is no authorial attribution). In it, Silliman notes that "it is proper that some mention of this great national work should be made, in publications less transient than newspapers; and as the fine arts are included within the design of this Journal, it may with propriety be noticed here. This is the greatest work which the art of painting has ever produced in the United States." Sillman mixed his appreciation for the painting with the patriotic sentiments to

which a view of it gave rise; as he analyzed the painting, he took the opportunity to wax poetic about the national pride it displayed:

> . . . in this picture, the United States posses a treasure to which there is no parallel in the world. In no instance, within our knowledge, is there an exhibition to an equal extent, of the actual portraits of an illustrious assembly, concerned in so momentous a transaction . . . . we trust that the government will promptly second what we doubt not the united voice of the nation will demand -- that the illustrious artist should dedicate the evening of his life to his country's honour and glory. (I.2.202-3)

Silliman made no effort, in this article, to tie his discussion of the painting to science, empiricism, or "the useful arts." This shows, to some degree, how deeply he believed that one of the main purposes of the journal was to foster American nationalism.

To some readers, however, such musings were more than out of place -- they were an impediment to the scientific utility of the journal. Amos Eaton, a former student of Silliman's who later became his biggest rival in the field of geology, was one such dissenter.[111] Eaton's disagreement with Silliman over whether the journal should publish articles on topics other than science was somewhat personal. In a letter written to a friend, Eaton described Silliman with contempt:

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[111] Greene, 244. Eaton was a colorful character who become one of the country's most esteemed geologists after his release from prison in 1815. He had been condemned to a life sentence under false accusations of fraud related to the payments of his debts. After being pardoned by Governor Daniel D. Tomkins, Eaton entered Yale at age thirty-nine. Ethel M. McAllister, *Amos Eaton: Scientist and Educator, 1776-1842*. Philadelphia: U. of Pennsylvania P., 1941; 90-157.

> I can tell you the good and the bad of him in a few words. He is an excellent practical chemist and a good *cabinet* mineralogist. With very little knowledge he affects much. He is impatient when his opinions are questioned, has a very lofty conception attached to the stupendous title of Professor of Yale College; and expects us to be ever mindful of his honourable marriage into the family of Governor Trumbell.[112]

Silliman's biographer has called this description "both damning and just."[113] Though Silliman was beloved by many of his students, his imperious nature and prominence in the public sphere left him open to such criticism.

Eaton believed that Silliman's inclusion of articles on the fine arts was a mistake that demeaned the scientific value of the journal. Writing to the editors of the *Annals* of the New York Lyceum, Eaton complained:

> To be *emphatically* serious, the Journal of Silliman, the N. York Magazine etc. have admitted such puerile wretched trash, that I am heartily sick of American periodical works. Silliman's last number contained something, but he studies to please fools . . . I am prepared with the best article on Geology I ever wrote. But I know not what to do with it. Silliman will not know whether it is worth printing or not. He will print it to be sure if I

[112] Brown, 311.

[113] Brown, 311.

> send it. But he would prefer a long dull mess of trash about Music, or William's toad.[114]

Such criticism did not, in the end, prevent Eaton from sending contributions to the journal, and Silliman responded by including reviews and notices of Eaton's books in its pages.

The scholar Phillip Round has pointed out that, in addition to articles specifically devoted to the arts, an artistic sensibility bled into the journal's scientific reports as well. Round argues that "as important as are the lists of minerals and the layers of strata, the 'impressions' which the scenery creates upon a tasteful viewer stand out as the primary hermeneutic of the culture of common sense." This seems like a fair point, since it is true that more than one article in the journal deviated from the empirical methodology of practical science to expand lyrically upon the beauties of the landscape under discussion. Round perhaps goes too far, however, when he claims that "**most** articles in the *Journal* thus necessarily move beyond mere empirical description and into scenic rapture;"[115] he takes as his test case the article by the Rev. Elias Cornelius on the Natural Bridge described earlier in this chapter. But as I have shown, the subject and style of Cornelius' article had an antecedent in Jefferson's *Notes on the State of Virginia*. While more than one article in the *Journal* displayed an ornate rhetorical style, it would be misleading to suggest that this was the dominant trope of the journal. In truth, the journal displayed

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[114] Amos Eaton to John Torrey, August 15, 1820. In John F. Fulton and Elizabeth H. Thomson, *Benjamin Silliman: Pathfinder in American Science*. New York: Henry Schuman, 1947; 127-8.

[115] Phillip Harris Round, "Scientific Americans: Natural History and the Rhetoric of National Identity, 1630-1862," diss., UCLA, 1990; 299 (emphasis added).

many forms of style -- and it was, in part, this multiplicity of discourse that broadened its appeal in the marketplace.

In his introduction to the first issue of the journal, Silliman had put forward an important motivation for including the arts in the purview of the journal:

> Science and art mutually assist each other; the arts furnish facts and materials to science, and science illuminates the path of the arts. (I.i.8)

Silliman's most important motivation for publishing articles on the arts, then, was not financial; rather, he believed that the arts played a central role in the empirical process by providing "facts and materials to science." Silliman did not elaborate on what he meant by this, but it is evident that he believed strongly that the arts could help promote an empirical "culture of proof." Silliman's second claim -- that science could illuminate "the path of the arts," was proven true most emphatically in later years by the invention of photography, even though some commentators argued that the medium's basis in science disqualified it from achieving the status of fine art. But for Silliman, the most important point was his first one: science and art promoted one another's progress; and together, they promoted "the culture of proof" in ever-widening circles of society.

Science and Religion in Silliman's Journal

It is clear that by including coverage of the Arts in what was primarily a scientific journal, Silliman increased the potential size of its audience. The broadened purview of the journal helped spread the ideology and practice of empiricism into mainstream American culture, where the notion of basing arguments and opinions on facts and experience, rather than on supposition or classical rhetoric, became increasingly popular.

For Silliman and many of his contributors, however, empiricism had a higher purpose. A deeply religious man, Silliman felt that the ultimate goal of science was to articulate the beauty of divine handiwork. The intricate patterns that he and his fellow researchers saw as they examined the American landscape seemed to bear the signature of a higher power.

Silliman had grown up in a devout household. In his biography, he credits his mother for his early religious training; on rainy days, he recounted, he and his brother would sit with her and recite Scripture or sing hymns. Their father, who was "much engrossed by public and private duties," had a less direct effect on their religious schooling, but "his daily life shed a holy influence over the family." Silliman wrote that "we breathed in a religious atmosphere, and our sentiments and manners were influenced and formed by a Christian standard of thought and action."[116]

[116] Fisher, 17.

In 1802, Silliman was in final year of his tutorship at Yale College when a large religious revival sprung up there. Silliman, who was twenty-three at the time, wrote a letter to his mother that expressed his newfound devotion to religious life:

> . . . . It would delight your heart, my dear mother, to see how the trophies of the Cross are multiplied in this Institution. Yale College is a little temple: prayer and praise seem to be the delight of the greater part of the students, while those who are still unfeeling are awed into respectful silence. Pray for me, my dear mother, that while I am attempted to forward others in the journey to heaven, I may not be myself a castaway.[117]

As noted earlier in this chapter, Silliman was appointed to a full-time professorship in Natural Philosophy and Chemistry -- one of twenty-one full-time scientific jobs in the country -- later in the same year. The man who appointed him, Yale President Timothy Dwight, was the grandson of Jonathan Edwards (his mother Mary was Edwards' third daughter), and it was Dwight who led the revival Silliman described.[118] Though this might seem to suggest an ulterior motive for Silliman's religious enthusiasm -- joining the revivals certainly could not have harmed his professional advancement -- his

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[117] Fisher, 83.

[118] Dwight would go on to be elected college pastor, and would lead revivals in 1808, 1812-13, and 1815. The Chaplain's Office at Yale College, "Important Dates in the History of Religion at Yale." October 8, 2005. <http://www.yale.edu/chaplain/battell/dates.html>

correspondence shows that his religious fervor was genuine. In another letter written to his mother, he fully expressed his ardent belief:

> *Sabbath and Communion Day*. -- This day I intend, with the permission and assistance of the good Spirit of God, to give myself up publicly in a perpetual covenant with God as my Father, with Jesus Christ as my Saviour, and with the Holy Ghost as my Sanctifier. O Thou Triune God, my Creator, my Redeemer, and my Sanctifier, accept me in the Covenant of Grace; dispose of me according to thy own good pleasure; employ me in thy service; save me in thy own way; and enable me to perform with sincerity the solemn act of publicly committing my soul into thy hands. . . . O my Redeemer, when this day for the first time I taste the bread, the sacred symbol of thy blood, which was shed for my sins, may I be melted with grief for my sins, warmed with gratitude for thy disinterested love, and elevated with hope by the remembrance that my Redeemer liveth, and that I shall stand before Him at the last day![119]

A year later, in 1803, Silliman wrote another letter in which he reflected upon this moment, noting that "This day completes a year . . . since I did publicly and solemnly give up my soul to God the Father, Son and Holy Ghosts. On that day, for the first time, I sat down at his table, and commemorated his dying love."[120] Among the blessings for

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[119] Fisher, 83-4.

[120] Fisher, 84.

which he was thankful, he included "an appointment which will afford me a comfortable and honorable support through life, with the prospect of extensive usefulness to youth and to my country."[121] In Silliman's mind, then, his job at Yale was tied to his religious reawakening; through God's grace, and the provenance of Yale College, he would engage in a mission to be useful to his country. Thus was the nationalism so evident in the early years of *The American Journal of Science* also tied to a religious imperative.

When he published the first issue of *The American Journal of Science* fifteen years later, Silliman's religious devotion had not dimmed. Rather, he continued to incorporate his religious belief into his scientific work. He closed his introduction to the first issue with a proclamation:

> In a word, the whole circle of physical science is directly applicable to human wants, and constantly holds out a light to the practical arts; it thus polishes and benefits society, and every where demonstrates both supreme intelligence, and harmony and benificence of design in THE CREATOR. (I.i.8)

The above paragraph, which immediately followed Silliman's contention that "the arts furnish facts and materials to science, and science illuminates the path of the arts," connected the sciences and arts to the journal and to each other; the sciences to empiricism; empiricism to God; and God, in the final circle, back to *The American Journal of Science*. In its pages, this first issue of the journal promised, the culture of

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[121] Fisher, 84-5.

proof would rise -- and it would do so by examining the “harmony and beneficence” of divine intention and design. As we shall see in the next chapter, the conjunction of science and religion was common during the period. Empiricism was the perfect cloud in which scientific and religious beliefs could meet; and it was this commingling of discourses, this condensation of empirical ideas, that precipitated the rise of “the culture of proof” in America.

Chapter 3

The Circle of Omniscience

> "Nature and Nature's Law lay hid in Night;
> God said, *Let Newton Be!* and all was Light."
>
> — Alexander Pope, "Epitaph Intended for Sir Isaac Newton"

In June of 1825, the Reverend Edward Hitchcock -- a Congregationalist minister and a prominent geologist whom Benjamin Silliman had mentored at Yale -- published an article in *The American Journal of Science* about a newly discovered fungus. Titled "Physiology of the Gyropodium Coccineum," the article described, in vivid detail, the dissection of a specimen Hitchcock had found in Whately, Massachusetts. According to Hitchcock's essay, the fungus would have pleased anyone with a taste for gooey, gelatinous, or putrid substances. As he cut through "irregular grooves and cavities, appearing on dissection, like strings of glue confusedly twisted together, and a softer jelly, in a partially dissolving state," until he reached the "white pulpy mass" at the center of the innermost sack, Hitchcock doted upon each subtle feature of his specimen. The extended, poetic, and almost sensual description of the dissection was a departure for the staid scientific journal. The central function of the essay was not to advance a scientific claim or to share the results of a particularly interesting experiment; rather, Hitchcock hoped to demonstrate to his scientific peers that God was at the heart of modern science.

In the penultimate paragraph of the article, Hitchcock admired the ingenious construction of the valves of the mushroom, suggesting that their intricate design, which

imparted "a greater degree of strength and elasticity" to the organism, might be adopted favorably in the human realm of practical mechanics. This observation brought Hitchcock to his central point, which he hammered home in the last paragraph of the essay:

> Thus, if I am not mistaken, (and I have taken much pains to attain the truth on the subject,) we find in this mere fungus, which, to the passing traveler appears to be a disgusting mass of half decayed vegetable matter, such evidence of contrivance and design, as is calculated to lead the thoughts irresistibly to a Great First Cause. How pleasant to meet with such mementos of Divine Wisdom where least expected! They remind the naturalist, that however far removed in his excursions from human society, he is still within the circle of Omniscience. (IX.1.61)

Meant to show that even the most minute and repulsive objects under scientist's gaze could yield evidence of divine intention and design, Hitchcock's article was a religious parable in scientific dress. His ecclesiastical lesson served to remind the newly formed community of professional scientists that the empirical task of scientific investigation served a deeper purpose: the elucidation of divine will.[122] Its appearance in the foremost

[122] In this respect, Hitchcock's article reinforced Benjamin Silliman's contention, in the first issue of the journal, that "the whole circle of physical science is directly applicable to human wants, and constantly holds out a light to the practical arts; it thus polishes and benefits society, and every where demonstrates both supreme intelligence, and harmony and benificence of design in THE CREATOR" (I.i.8).

scientific publication of its day underscores the intimacy of scientific and religious discourse in antebellum America.

Indeed, before the 1859 publication of Charles Darwin's *On the Origin of Species* clove them apart, science and religion in America had taken part in an increasingly shared cultural discourse. Sometimes contradicting and sometimes complementing each other, scientific and religious leaders were in constant conversation throughout the first half of the nineteenth century: theologians engaged in a surprising number of scientific debates and encouraged specific scientific methodologies over others; and many scientists produced their work under the often explicit assumption that their research helped prove that universe was on a teleological track designed by God for the benefit of humankind. There were, to be sure, great conflicts between scientists and religious figures before 1859 -- the furor over Darwin's book was the culmination of a long debate over the evidence of "original design" -- but even those conflicts drew the two disciplines into closer dialogue. What most united science and religion during the first half of the nineteenth century was a subtle discursive similarity: a heightened awareness of the importance of proof to successful argumentation, a strong emphasis on the documentation of empirical facts, and an increasing concentration on visible forms of proof.

This shared culture of evidentiary proof must be considered by those seeking to understand the reception of photography in America, because it conditioned many of the ideas and terms people used to describe the new medium in its early years. The notion of the camera as an infallible witness and the idea that the camera allowed the sun to paint itself grew out of antebellum debates over the visible presence of God's will in the

natural world and the accessibility of grace in modern theology. Scientific by nature and mystical by nurture, the camera seemed to fuse scientific and spiritual truths.

The "culture of proof" described above had heterogeneous roots in religious and scientific circles, and was expressed in different ways by members of the two disciplines. This chapter traces the rise of the documentation of natural facts in American religious circles -- a crucial element of the culture of proof that helped position photography as the century's most important tool of documentation. The trope of the camera as an objective observer in mid-to-late nineteenth-century science has been a subject of much discussion in the fields of the scientific history and visual studies. Less remarked upon are the ways in which the camera answered calls for the documentation of natural facts that emanated from religious, rather than scientific, circles. The move towards documentary proof in religion was hastened by the rise of secularism, and brought to fruition by influences as diverse as natural theology and literary Transcendentalism. The first part of this chapter engages in a historiographic discussion of religious and scientific discourse in the antebellum period. It then considers the rise of natural theology and the emergence of new preaching styles among evangelical ministers such as Charles Grandison Finney. Finally, it turns towards Ralph Waldo Emerson to analyze the ways in which the Emersonian concept of the transparent eyeball prefigured not only the camera itself, but also the rhetorical terms in which it would be received.

Scientific and Religious Discourse -- Conflict or Dialogue?

In recent decades, historiographical work in the burgeoning field of the History of Science has sought to correct the commonplace notion that scientists and theologians were in near-constant conflict from the Enlightenment through the age of Darwin. Despite the broadness of that claim, it has been widely influential in both academic fields and popular histories of the period. Scholars such as Claude Welch, Ronald Numbers, Ian G. Barbour, and John Hedley Brooke have argued that the warfare, or conflict, model belongs more to the realm of myth than reality.[123] Such scholars have shown that a historical model that emphasizes conflict ignores at its peril the considerable complexity that characterized nineteenth-century interactions between scientific investigation and religious belief.[124]

The conflict model was put forward most influentially in two nineteenth-century historical texts -- John Draper's *History of the Conflict Between Religion and Science*

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[123] See Claude Welch, "Dispelling Some Myths About the Split Between Theology and Science in the Nineteenth Century" in *Religion & Science: History, Method, Diaogue*, W. Mark Richardson and Wesley J. Wildman, eds. New York: Routledge, 1996; John Hedley Brooke, "Science and Theology in the Enlightenment" in *Religion & Science*; Colin A. Russell, "The Conflict of Science and Religion" and David B. Wilson, "The Historiography of Science and Religion" in *Science and Religion: A Historical Introduction*, ed. Gary B. Ferngren. Baltimore: The Johns Hopkins University Press, 2002; Ian G. Barbour, *Religion and Science: Historical and Contemporary Issues*. San Francisco: HarperCollins, 1997. Richard G. Olson, *Science and Religion: 1450-1900, From Copernicus to Darwin*. Westport, Connecticut: Greenwood Press, 2004; John Hedley Brooke, *Science and Religion: Some Historical Perspectives*. New York: University of Cambridge Press, 1991; and Ronald Numbers, "Science and Religion." *Osiris* 2nd series (1985) 1:58-80.

[124] Welch, 29.

(1874) and Andrew Dickson White's *A History of the Warfare of Science with Theology in Christendom* (1896). Both works appeared in the aftermath of the rancorous debates over Darwin's evolutionary theories, a time when conservative theology seemed to retreat before the secularizing advance of science. Draper contended that the aims of science and religion were, by definition, at loggerheads:

> The history of Science is not a mere record of isolated discoveries; it is a narrative of the conflict of two contending powers, the expansive force of the human intellect on one side, and the compression arising from traditionary faith and human interests on the other.[125]

One could not claim that Draper was demure about his biases -- science limned the "expansive force of the human intellect," while religion squelched intellectual inquiry. Draper argued, further, that religious faith was stable and unchangeable, while science was "progressive." He concluded that, as a result of these inherent differences, "a divergence between them . . . must take place."[126] Ronald Numbers writes that Draper's book might have been more accurately titled, "History of the Conflict Between Roman Catholicism and Science" because of its heavy emphasis on the resistance of the Roman

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[125] John Draper, *History of the Conflict Between Science and Religion*. 1874. New York: D. Appleton and Company, 1900; vi.

[126] Draper, vii.

Catholic Church to new scientific theories (in contrast to Protestant engagement with scientific work).[127]

In contrast to Draper's sweeping survey of science and religion, White's text made more discriminating distinctions as it singled out conflicts between science and a specific strain of religious thought -- "dogmatic theology." He concentrated on specific incidents, but retained Draper's metaphors of warfare in chapter titles such as "Theological Efforts to Crush the Scientific View."[128] As the scholar Donald Fleming has pointed out, Draper and White successfully set in place the ruling metaphors for discussions of nineteenth-century religion and science.[129] Scientists had much to gain from tropes of warfare: as they promoted the conflict thesis, one historian notes, scientists "could perpetuate a myth as part of their strategy to enhance the public appreciation of science."[130] With appreciation, of course, came both funding for scientific endeavors and a flood of new trainees into scientific fields. As the nineteenth century progressed, and scientific training became professionalized and formalized within university settings, young people increasingly had to make an early choice between a scientific career and a religious one; unlike previous generations, they could not pursue

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[127] Numbers, 61.

[128] Andrew Dickson White, *A History of the Warfare of Science With Theology in Christendom*. 1896, 2 vols. New York: D. Appleton and Company, 1907; 183.

[129] Donald Fleming, *John William Draper and the Religion of Science*. Philadelphia: University of Pennsylvania Press, 1950; 131. Quoted in Numbers, 59.

[130] Russell, 10.

both paths simultaneously.[131] The works discussed in this dissertation suggest that modern historians are correct to posit that the history of the period presents the case for a more variegated view of the relationship between religion and science in the antebellum period. But it must also be noted that the conflict model did not arise from the late-nineteenth century historical work of Draper and White alone. Rather, some participants in the debates over religion and science -- even evangelical Protestants -- *did* see the forces of science and religion arrayed against one another in conflict.[132] Even as they struggled to reconcile their faith with modern scientific discoveries, however, they tended to turn towards the empirical proof of science to bolster their points.

Whether or not scholars subscribe to the conflict model, most agree that the dialogue between science and religion during the first fifty years of the nineteenth century was punctuated by three important scientific works that shook the foundations upon which the relationship had been built. Each work, in its way, dealt a blow to the idea that human and animal species had been created by God, and had remained fixed and unchanged since they were first placed on the earth. In 1796, the French astronomer Pierre-Simon Laplace proposed the nebular hypothesis in *Exposition du systeme du monde*. He argued that the solar system was formed, without divine aid, by purely physical forces acting upon swirling clouds of gas. Although LaPlace's work undermined some of the most profound tenets of religious belief, most Americans either attributed his views to an anticlerical bias or found a way to incorporate his findings into

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[131] James Turner notes that universities opened thirty-five scientific departments between the 1840s and the 1870s. James Turner, *Without God, Without Creed: the Origins of Unbelief in America*. Baltimore: The Johns Hopkins U.P., 1985; 122-4.

[132] See my discussion of Edward Hitchcock's *The Religion of Geology* in Chapter 4 of this dissertation.

their belief systems without changing their fundamental views.[133] Building upon the work of James Hutton that was discussed in the previous chapter of this dissertation, Charles Lyell wrote the revolutionary *Principles of Geology* (1830-33), which similarly shocked traditionalists by positing that geological changes in the earth occurred over eons of time rather than in cataclysmic events, and that they involved no planetary forces that were not also active in the modern era. Lyell pointed to the layers of rock formed by lava flows in the Sicilian mountains, and to the fossils found under those strata, to show that such changes could only have occurred over long periods of time.[134] Lyell's book inspired Darwin to extend a similar hypothesis of gradual change through the ages to organic evolution. Finally, Robert Chambers put forward the argument that organic evolution was a natural law in his 1844 *Vestiges of Creation*. Even though Chambers attempted to couch his work as a tract of natural theology, it was widely (and angrily) decried as an attack on religious beliefs. Chambers had published his book anonymously because he anticipated exactly that reaction, but his experience served as a frightful example to Darwin, who delayed the publication of his own treatise on evolution for fifteen years.[135]

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[133] Paul Jerome Croce, *Science and Religion in the Era of William James*. Chapel Hill: The University of North Carolina Press, 1995; 91.
[134] Brooke, *Science and Religion*, 248-50.

[135] Further discussion of Darwin's delay may be found in Howard E. Gruber, *Darwin on Man*. New York: E.P. Dutton, 1974; Stephen Jay Gould, "Darwin's Delay," in *Ever Since Darwin*. New York: Norton, 1977; Barry G. Gale, *Evolution without Evidence: Charles Darwin and The Origin of Species*. Brighton, England: Harvester Press, 1982; Dov Ospovat, *The Development of Darwin's Theory: Natural History, Natural Theology, and Natural Selection, 1838-1859*. Cambridge: Cambridge University Press, 1981; Robert J. Richards, *Darwin and the Emergence of Evolutionary Theories of Mind and Behavior*. Chicago: University of Chicago Press, 1987; Robert R. Richards, "Why Darwin Delayed, or Interesting Problems and Models in the History of Science." *Journal*

Although these three scientific works posed considerable challenges to the peaceful coexistence of science and religion, most scientists in the first half of the nineteenth century continued to espouse religious beliefs and to frame their scientific work within religious paradigms, even if they had private doubts about the place of religion in science. The mineralogist and geologist James Dwight Dana, for example, wrote that scientists were "pupils of the infinite God," while Edward Hitchcock claimed that "the proper study of nature begets devout affections."[136] The historian of science Paul Jerome Croce has noted that these were "wholly typical scientific statements from this era," while another historian writes that "the mutual effort to reconcile science and religion merely underscores the broad-based desire within antebellum American culture to see that end achieved."[137] Throughout the period, as Croce affirms, most scientists took pains to point out that their work posed no danger to religious institutions or beliefs. Most scientists of the period, according to Croce, "readily announced that their researches into the natural world pointed with certainty to the reality and benevolence of God." Such affirmations of the religious underpinning of their work helped scientists calm public fears about the theological ramifications of their research.[138]

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of the History of the Behavioral Sciences 19 (1983): 45-53; and Adrian Desmond, *The Politics of Evolution: Morphology, Medicine, and Reform in Radical London*. Chicago: University of Chicago Press, 1989. These sources have been culled from Croce, 267n.60.

[136] James Dwight Dana, "Science and Scientific Schools," *American Journal of Education* 2 (1856): 349-74; 364; and Edward Hitchcock, "The Study of Natural History," *Knickerbocker* 25 (1845): 292.

[137] Croce, 92; and Walter H. Conser, Jr., *God and the Natural World*: *Religion and Science in Antebellum America*. Columbia, SC: University of South Carolina Press, 1993; 83.

[138] Croce, 91.

Natural Theology

Natural theology was the rhetorical adhesive that held the relationship of religion and science in place in the antebellum period. It provided well-reasoned arguments for the compatibility of scientific investigation and religious belief and emphasized that empirical investigation of the world by both scientists and theologians would prove the existence of a divine architect. Its central proponent was William Paley, who published *Natural Theology* in 1802; in that book, he argued that the intricate functioning of various bodily organs such as the eye and the hand proved that humankind had been designed by God. Starting with a hypothetical thought experiment in which a person finds a watch on the ground, and deduces from its mechanisms -- each perfectly adapted to its function -- that such an object could only have been wrought by intelligent hands, Paley engaged in a scientific analysis of human and animal anatomy in order to demonstrate that their complex construction could only have been made by an intelligent creator. Although this argument was by no means new, it was extraordinarily influential during the first half of the nineteenth century.[139] In words that were to ring out for more than a century, Paley summed up his argument by writing that "there cannot be design without a designer;

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[139] James Turner contends that Paley "cribbed shamelessly" from John Ray. In 1691, Ray published *The Wisdom of God Manifested in the Works of Creation*, and included within his examples the eye and hand, which Paley included in his work more than a century later. The influence of Paley's book may be seen in the comments of Charles Darwin, who counted *Natural Theology* among the most important texts he had read in his life (Paley's work was required reading at Cambridge when Darwin attended). Darwin's *Origin of Species*, needless to say, refuted Paley's text. Turner, 55, 96.

contrivance, without a contriver; order, without choice; arrangement, without any thing capable of arranging. . . ." [140]

Paley's book, as James Turner points out, "inspired a swarm of junior Paleys."[141] As a clearly reasoned work seemed to prove the existence of God in the modern world, it was seized upon by theologians at a time when confidence in the veracity of foundational biblical texts was in doubt. The book appealed not only to orthodox doctrinarians, however, but also to more moderate theologians. In 1830, the Unitarian minister Orville Dewey wrote that "it is not enough to say, in the general, that God is wise, good, and merciful . . . . We want statement, specifications, facts, details, that will illustrate the wonderful perfections of the infinite Creator."[142] Dewey's statement shows how natural theology gave comfort to theologians threatened by science; through its logic, they became convinced that science could be a boon, rather than a danger, to religious belief. The well-documented Protestant interest in science, too, derived from the encouragement that natural theology provided. The evangelist Charles Grandison Finney relied on arguments that William Paley advanced in *Natural Theology* as he urged his followers to "go out into every department of science, to find the proofs of *design*, and in this way to learn the existence of God." Finney believed that "studying science is studying the works of God."[143] Paul Jerome Croce has noted that natural theology "explicitly imitated

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[140] William Paley, *Natural Theology and Horæ Paulinæ*. New York: American Tract Society (undated); 15-16.

[141] Turner, 96.

[142] Quoted in Croce, 15.

[143] Charles Grandison Finney, *Lectures on Revivals in Religion*. Edited by William McLoughlin. Cambridge: Harvard University Press, 1960 [1895]; 218. Quoted in Croce, 56.

science in treating nature as a series of 'proof texts.'" With its Baconian focus on the gathering of facts and observations, and its antagonism towards deductive and theoretical hypothesizing, natural theology suggested that the accumulation of natural facts could provide further evidence of divine intention and design. The pull of science on religion was so powerful that some religious groups required aspiring preachers to be tested on scientific phenomena before they were allowed to demonstrate their knowledge of religious texts.[144]

Secularism, Intuition, and Knowledge

The religious movement towards a culture of proof was, in part, a reaction to the rise in secularism in the first half of the nineteenth-century.[145] The historian Merle Curti has argued that between 1830 and 1860, a variety of factors led to a relaxation of the hold of organized religion on American society. Curti frames this movement as part of a general trend of democratization and individualism in American society that was caused, in part, by Transcendentalism, the exploration of the West, and other socio-politico

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[144] Theodore Bozeman, *Protestants in an Age of Science*. Chapel Hill: UNC Press, 1977; 41-42.

[145] Paul Jerome Croce points out that until the mid 1990s, discussions of a rise in secularism in nineteenth-century America seemed outdated by contemporary scholarly standards, and were mostly confined to mid-twentieth century scholarship. Recent work, however, has revived an interest in secularism as a cultural phenomenon. Croce cites the work of David Hollinger, who uses the term to describe "the growth in size and in cultural authority of de-Christianized academic elites, and…the corresponding decline in the role played by churches in public life." Croce, 10-11.

factors. Increased secularization could be seen in relaxed observation of the Sabbath; the final termination of church-state ties in places such as Connecticut and Massachusetts; the proliferation of free-thought journals such as *The Beacon*; and the splintering of Calvinist practice into a wide-ranging group of evangelical faiths.[146] At the turn of the century, Americans had turned to their churches for their children's education and to their ministers for everything that they would later come to expect from their local newspapers.[147] The rise of industrial capitalism, which produced new technologies such as the power-driven printing press, diminished the roles of clergymen in their communities.

The changing relationship between religion and science was one of the most important harbingers of the growing secularization of American society. James Turner has argued that the rise of secularism in the nineteenth century should be understood not as a question of anti-religious feeling, but rather as an issue of growing apathy towards religion. Turner suggests that this apathy came about during the first half of the nineteenth century. As scientific authority increased, religious leaders responded by patterning their doctrines on scientific models. But when religious belief seemed to fall short of scientific certainty, its followers drifted towards the more provable claims of science.[148]

One of the undercurrents of Turner's argument is that secularization was not an unstoppable force of cultural change that crept up on religious power while it dozed

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[146] Merle Curti, *The Growth of American Thought,* 3rd Edition. New York: Harper & Row, 1964 (1st ed. 1948); 299.
[147] Turner, 120.

[148] Turner, 13-25.

unaware; rather, theologians played an active (though unintended) role in bringing about a crisis of religious authority by ceding important grounds of belief to science. When they chose to ally themselves, through natural theology, with the rational empiricism of the sciences, they let go of the "ancient unreflective certainties" that comprised their greatest strength.[149] But, as Turner elaborates later, the widely perceived loss of faith in religious institutions occurred at least partially because theologians relinquished intuition -- the internal and private knowledge of the divine -- as a primary foundation of belief. The notion that intuition provided humans with intimate knowledge of God had been espoused by Calvin, Cotton Mather, and Jonathan Edwards; it was a primary component of the common sense philosophy promoted by Scottish Enlightenment figures such as Thomas Reid.[150] In America, Evangelical Protestantism, which emphasized the knowledge of the heart over the rationalism of the head, was similarly built upon a philosophy of intuition. Turner cautions against taking the private/public split of faith-based intuition and science-based empiricism too far, however, since evangelicals considered intuition to be an objective fact of consciousness.[151]

Opposition to natural theology as a way towards knowledge of the divine also grounded American romanticism. Following Samuel Coleridge, whose *Aids to Reflection* was published in 1825, the philosopher and president of the University of Vermont,

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[149] Croce, 14-15.

[150] Turner, 104-5. According to Turner, the intellectual structure of evangelical intuitionism grew from philosophers of the Scottish Enlightenment, "for whom a 'moral sense' and 'self-evident' pre-rational intuitions provided weapons against Hume's skepticism" (104).

[151] Turner, 106.

James Marsh, published an influential American edition of Coleridge's work. Marsh believed that natural theology led theologians down a dangerous path; if Paley's arguments were the best foot theologians had to put forward, he argued, they were destined to walk towards skepticism.[152] Turner cites two lines of thought that descended, through Marsh, from Coleridge: on one hand, American Transcendentalists such as Theodore Parker emphasized the intuitive knowledge of God that could be gleaned from experience in nature; and on the other hand, mainstream American Protestants such as Horace Bushnell emphasized that faith could not be based on logic -- it was something to be felt in the heart, not argued in the head.[153] And yet, evangelicals could be faulted for not taking this argument to its furthest point and putting the authority of religion beyond the reach of science. Turner writes:

> [Evangelicals] shied away from claiming plainly that knowledge extended beyond a scientific style of reasoning, or from admitting that conviction of God might have to rest on human experience more subjective than knowledge of nature. They did not want to confess that belief might lie outside the purview of logical analysis and empirical observation, for to do so would have meant sacrificing the prestige of science and the comforting assurance that hard-headed men could establish God as surely as they could tote up the day's receipts in their counting houses. (109)

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[152] Turner, 106-7.

[153] Turner, 107.

And so, as Paul Jerome Croce neatly summarizes, "religion let the Trojan horse of science into the citadel of faith.[154] Before the Trojan horse entered the citadel, however, many church leaders sought to stem the tide of parishioners away from their churches by democratizing religious authority. In what James Turner has called "an end-run around secularization," preachers moved away from older church institutions in order to create new avenues for religious influence on American life.[155] Evangelical movements, of course, gathered momentum from a number of societal changes, but the general effort to democratize worship by allowing the flock to lead the shepherd was one part of the religious fight against secularizing influences. Both of these trends -- the hope for finding observable proof of the existence of God, and the increasing democratization of worship and grace -- would become integral parts of the culture that greeted photography in the 1840s.

Regardless of the intellectual heritage of the choices made by theologians in response to science in the antebellum period, the fact remains that not only did religion begin to lose influence while science gained it; more importantly, for the purposes of this study, the idea that empirical investigation could lead one towards physical proof of the existence of God gained credence during this period. Each spring, nature seemed to swell with the magnitude of God's visage. And the promise of new technology was that with

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[154] Croce, 15-16. John Hedley Brooke uses the Trojan Horse metaphor similarly in *Science and Religion: Some Historical Perspectives*: "The fact that a theory of organic transformation [Robert Chambers' *Vestiges of the natural history of creation*] could be framed in this way provides yet another instance of that ironic pattern we have discerned in earlier contexts. The association of natural theology with the extension of natural law had an effect rather like the Trojan horse. It smuggled a full-blown naturalism into territory that upholders of a more conservative natural theology, such as Whewell, still considered holy ground." Brooke, 223.

[155] Turner, 125.

sharper and sharper instruments, humans could come closer and closer to deciphering the features of that face. People yearned to see the world through God's eyes; it was not until the invention of the daguerreotype that they believed they had done it.

States of Grace

Beginning with the Cane Ridge communion of 1801, a new wave of revivalist preaching spread across the United States, culminating in the Second Great Awakening of 1831-7. Long noted as an important epoch in American religious history, the Second Great Awakening is especially notable, within the bounds of this study, for the innovations in religious style that it produced. During this period, evangelical and revivalist preaching reshaped religious practices by placing a new emphasis on the visible demonstration of grace. No longer restrained by a Calvinist sense of predestination or unconditional election, or by a Puritan sense of social restraint, revivalist ceremonies became roiling public events at which preachers used the brunt force of peer pressure to effect religious conversion. Through displays of grace that ranged from crying and yelling to fainting and barking, worshippers showed proof of their conversion in an arena that was increasingly public. In some religious circles, at least, it was no longer enough to feel God's grace in private; such good fortune was to be celebrated -- and, by extension, proven -- before a large group of peers

The Cane Ridge revival of 1801 had a seismic influence not only on American religious history, but American history more generally. The religious historian Sydney

Ahlstrom has called it "a watershed in American church history."[156] Although accounts of the seven day revival in central Kentucky have been disputed since the event itself – with estimates of the crowds ranging from ten to twenty-five thousand people – it left an indelible mark on those who attended or heard about it. Indeed, it is hard to separate the event itself from the outsized tales that were told about it. The most remarked upon aspect of the revival was undoubtedly the physical effects that preachers produced in their audiences during the meeting; and it is this aspect of the event that I wish to concentrate on here, for it demonstrates an important religious contribution to the "culture of proof."

A modern historian has compared the atmosphere at Cane Ridge, Kentucky during the revival of 1801 to that of a circus, and descriptions of the event seem to bear that out.[157] Taking place in a western settlement, the revival drew the faithful and the curious from hundreds of miles around. In evocative prose, Sydney Ahlstrom urges us to imagine the scene:

> the milling crowds of hardened frontier farmers, tobacco-chewing, tough-spoken, notoriously profane, famous for their alcoholic thirst; their scarcely demure wives and large broods of children; the rough clearing, the rows of wagons and crude, improvised tents with horses staked out behind; the gesticulating speaker on a rude platform, or perhaps simply a

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[156] Sydney E. Ahlstrom, *A Religious History of the American People*. 2 vols. Garden City, New York: Image Books, 1975; vol. 1, 525.

[157] Paul K. Conkin, *Cane Ridge: America's Pentecost*. Madison, Wis. : University of Wisconsin Press, 1990; 92.

> preacher holding forth from a fallen tree. At night, when the forest's edge was limned by the flickering light of many campfires, the effect of apparent miracles would be heightened. . . . And underlying every other conditioning circumstance was the immense loneliness of the frontier farmer's normal life and the exhilaration of participating in so large a social occasion.[158]

As word of the revival spread, the meeting grew larger; farmers, frontiersmen, women, and children all came out on the concluding Sunday of the event to participate in an enormous public gathering. It ended, purportedly, only because organizers ran out of provisions for crowd. One critic of the event noted wryly that "more souls were begot than saved,"[159] which proves a point that even those who would discuss only the religious aspects of the event could agree on: the revival was an intensely social experience. And many people, no doubt, came as spectators for the great human drama that unfolded there.

At the revival, one witness reported that he saw "seven ministers, all preaching at one time, some on stumps, others in wagons, and one . . . standing on a tree."[160] In the middle of this chaotic scene was Barton Warren Stone, the Kentucky Presbyterian minister who put out the call for the Cane Ridge meeting. Stone catalogued what has

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[158] Ahlstrom, 526.

[159] Ahlstrom, 526.

[160] William Garrett West, *Barton Warren Stone: Early American Advocate of Christian Unity*. Nashville, Tennessee: The Disciples of Christ Historical Society, 1954; 32. The man quoted was James B. Finley, "a famous Methodist circuit rider."

become the enduring legacy of Cane Ridge: the extraordinary "bodily agitations" that attendees went through as they listened to the preachers and were overcome by the Spirit:

> The subject of [the falling exercise] would, generally, with a piercing scream, fall like a log on the floor, earth, or mud, and appear as dead . . .
>
> The jerks cannot be so easily described. Sometimes the subject of the jerks would be affected in some one member of the body, and sometimes the whole system. When the head alone was affected, it would be jerked backward and forward, or from side to side, so quickly that the features of the face could not be distinguished. When the whole system was affected, I have seen the person stand in one place, and jerk backward and forward in quick succession, their head nearly touching the floor behind and before. . .
>
> The dancing exercise. . . The subject, after jerking awhile, began to dance, and then the jerks would cease. Such dancing was indeed heavenly to the spectators; there was nothing in it like levity, nor calculated to excite levity in the beholders. . .
>
> The laughing exercise was frequent, confined solely with the religious. It was a loud, hearty laughter, but one *sui generic*; it excited laughter in none

> else. The subject appeared rapturously solemn, and his laughter excited solemnity in saints and sinners. It is truly indescribable.[161]

Another eyewitness described "the barking exercise," in which the affected meeting-goers engaged in sudden and unpredictable imitations of canine behavior:

> It was common to hear people barking like a flock of spaniels . . . They would start up suddenly in a fit of barking, rush out, roam around and in a short time come barking and foaming back. Down on all fours they sometimes went, growling, snapping their teeth, and barking just like dogs.[162]

Stone's descriptions of these agitations remain among the most famous accounts of the events, and are primarily responsible for the notoriety of the Cane Ridge revival. That these remarkable and wild "bodily agitations" occurred in the West, in the liminal space of the frontier, was not lost on many who heard about them. Many conservative preachers, who disapproved of the wild actions Stone described, were disturbed by his accounts -- most notably because of the sympathetic tone Stone used while writing about them. Indeed, the Cane Ridge revival and its aftermath provoked a minor rift in the

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[161] "A Short History of the Life of Barton W. Stone Written by Himself," in *Voices from Cane Ridge*, ed. Rhodes Thomspon, facsimile ed. Saint Louise: Bethany Press, 1934; 68. Cited in Ahlstrom, 526.

[162] West, 36.

Presbyterian church; Stone ended up leaving his long-standing office so that he might no longer be constrained by church dogma.[163]

Accounts of the Cane Ridge communion helped popularize the concept of bodily agitations in mainstream religious culture in America. Even if conservative American clergymen openly disapproved of such behavior, Cane Ridge helped spread the idea among evangelical Protestants that parishioners could become so swept by the divine spirit that they lost physical control of their bodies.[164] There was an essential social element to such behavior -- it was, at base, a display of faith that occurred in public, social settings. The motivations for such behavior might be debated, but it had the effect of encouraging a culture of display upon meeting-goers. No longer the mute recipients of a clergymen's sermon, singing hymns from numbered pews in quiet tones, the attendees of revivalist services were required, through peer pressure, to show proof of their conversion before their peers. Grace was no longer something meted out before human history, but was now accessible and visible in the present moment. Men and women had the opportunity to be saved, but redemption now carried more than a spiritual requirement -- it became performative. Like a piece of empirical evidence used to substantiate a scientific theory, grace had to be proven through public display. This had the effect of making revivalist ceremonies grand dramas -- the skills of the preacher could be judged by the enthusiasm he stoked; as one historian has put it, "the falling exercises

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[163] West provides a full account of Stone's split from the Presbyterian Church, and his efforts to create a more unified form of Christianity, in his book. See especially chapters IV ("Conflict with the Presbyterians") and V ("New Light Dissenters").

[164] While this certainly was not a new idea -- everything from the religious practices of the Shakers to the idea of speaking in tongues had been part of the popular imagination for centuries -- the Cane Ridge revival helped make "bodily agitations" an acceptable part of revivalist religious rites.

were an inevitable part of every meeting. Soon the success of meetings was measured by the number struck down."[165] The pressure to enact the effects of Grace for one's peers thus became not only a pressure felt by parishioners, but also by the ministers who preached to them. Revivals were judged by numbers -- reflecting, in the religious sphere, a scientific sense of quantification -- and by the enthusiasm they generated in local communities.

The new evangelical preaching style of the Cane Ridge Revival reached its apogee during the Second Great Awakening under the well-practiced hand of Charles Grandison Finney. Between 1831 and 1837, Finney, along with Lyman Beecher, presided over a remarkable period in American religious history, as a wave of evangelical enthusiasm, accompanied by a strong campaign of moral reform, swept from Rochester, New York to Wilmington, Delaware, to New York City. Sometimes called "the father of modern revivalism,"[166] Finney converted thousands of Americans to evangelical Christianity and moral reform. But his influence went beyond merely popularizing Christianity -- his preaching style was as successful and impressive as the number of converts it helped created. Finney helped pioneer an entirely new form of preaching -- one based, like the revival preaching at Cane Ridge, on showing proof of conversion -- that changed the very nature of public worship in America.

Finney's preaching techniques revolved around group prayer -- he wrote that "Nothing is more calculated to beget a spirit of prayer, than to unite in social prayer with

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[165] West, 34.

[166] Ahlstrom, 556.

one who has the spirit himself."[167] He championed long, "protracted meetings" that went from early morning to late evening, and often continued over the breadth of several days. Within this group setting, Finney was tenacious, using every available technique of persuasion to compel his listeners to surrender themselves to God. He would call out, by name, prominent members of the community who were missing from church services; convert the wives of prosperous merchants in the hope that they would able to convert their husbands; and publicize his activities through pamphlets and advertisements.[168] Finney would identify sinners in the audience and admonish them relentlessly: "Oh, God, smite that wicked man, that hardened sinner . . . Oh God, send trouble, anguish and affliction into his bed chamber this night . . . God Almighty, shake him over hell!"[169] Faced with this kind of high-pressure salesmanship, few could resist.

Finney's personal style was direct and blunt -- sometimes even brutal. He filled his listeners with fear and awe -- and they stumbled out of his meetings to do his bidding with fervent enthusiasm. One historian writes that Finney inspired so much zeal in his converts that some of them verged on "emotional terrorism" as they hounded their friends and relatives to convert.[170] In his memoirs, Finney described the strategy he used to convert a prominent family in Utica. During the revival at Western, in upstate New York, Finney resolved to convert the family of one of the town's elders. Finney began

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[167] Quoted in Paul E. Johnson, *A Shopkeeper's Millennium: Society and Revivals in Rochester, New York, 1815-1837*. New York: Hill and Wang, 1978; 97.

[168] Ahlstrom, 557; Johnson, 95-135.

[169] Quoted in William G. McLoughlin, *Revivals, Awakenings, and Reform: An Essay on Religious and Social Change in America*, 1607-1977. Chicago: University of Chicago Press, 1980; 125.

[170] Johnson, 98.

with the eldest daughter, Sarah, whose "life had been so irreproachable that it was very difficult to convict her of sin."[171] Finney felt that the family's love of Sarah gave her a sense of "self-righteousness" that prevented him from "trying to make her see herself as a great sinner notwithstanding her morality." When he found himself unable to convert Sarah, Finney decided to "bide [his] time," hoping to catch her "away from home, or alone." An opportunity soon arose, and Finney found himself in isolated conversation with the daughter. With "God's help," he "stripped the covering from her heart, and she was brought under powerful conviction for sin."[172] This daughter's conversion surprised her family; but Finney continued to visit the family "almost daily, and sometimes two or three times a day." Through these constant visits, Finney managed to convert one child after another. But he prided himself most on having converted the once-haughty Sarah, who "broke thoroughly down" before she converted and became "as beautiful a convert as perhaps [Finney] had ever seen."[173]

Finney approached revivals with a scientific and practical mindset. He did not believe that conversions achieved during revivals were the work of miracles or divine mystery. Rather, he argued that any preacher who used the proper means could achieve a successful revival:

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[171] Charles Grandison Finney, *The Memoirs of Charles G. Finney: The Complete Restored Text*. Garth M. Rosell and Richard A. G. Dupuis, eds. Grand Rapids, Mich.: Academie Books, 1989; 148.

[172] Finney, 148-9. It is difficult to overlook the undertones of sexual violence in Finney's imagery.

[173] Finney, 149.

> A revival is not a miracle; it consists entirely in the right exercise of the powers of nature . . . . The connection between the right use of means for a revival and a revival is as philosophically sure as between the right use of means to raise grain and a crop of wheat.[174]

Those means included widespread advertising and lobbying in every community he entered. Finney, who began proselytizing in 1821, used techniques modeled on the Jacksonian political world taking shape around him, and approached revivals like elections. "What do politicians do?" he asked. "They get up meetings, circulate handbillls and pamphlets, blaze away in the newspapers, send coaches all over town with handbills . . . all to gain attention to their cause and elect their candidates."[175] Any minister who wanted to attract a similarly wide audience, he implied, would be wise to emulate those methods. He wrote that "the object of the ministry is to get all the people to feel that the devil has no right to rule this world but that they ought to give themselves to God and vote in the Lord Jesus Christ as the governor of the Universe."[176] Finney ran one of the most effective get-out-the-vote campaigns in American history, and claimed that the results of his preaching -- calculated by the number of churches he filled and the enthusiasm he generated -- justified his methods. "Better a full church with undignified preaching," he said, "than an empty one with it."[177]

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[174] Quoted in McLoughlin, 125.

[175] Quoted in McLoughlin, 126.

[176] McLoughlin, 126.

[177] McLoughlin, 126.

Finney's doctrinal teachings differed significantly from the established norm, particularly on the subject of conversion. Many clergymen believed that a period of waiting had to be established between a person's surrender to the Holy Spirit and their conversion to the church, in order to ensure that the act was not ephemeral, and that the person would lead a pious life following the conversion. Finney, however, preached that no period of waiting was necessary, and accepted immediately those whom he had converted. He argued that those under the old system of "protracted conviction . . . were in danger of grieving the Spirit of God away."[178] Instead, he wanted to capitalize on the moment and on the enthusiasm he generated. While his opponents claimed that his system produced unreliable conversions, Finney argued that his practice of immediate conviction and conversion -- sometimes "in the course of a few hours, and sometimes in the course of a few minutes" -- formed converts just as strong in the Spirit as the older system. Reflecting on this controversy, he wrote:

> Such sudden conversions were alarming to many good people; and of course they feared and predicted that they would fall away, and prove not to be soundly converted. But the event proved that among those sudden conversions were some of the most powerful Christians that ever have been known in that region of country; and this has been in accordance with my own experience through all my ministry.[179]

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[178] Finney, 191.

[179] Finney, 191.

Finney taught, then, that parishioners could have immediate access to the Spirit of God, and argued that the truth of that experience was proven by the subsequent behavior of those converted. This philosophy of conversion, of course, was vital to Finney's success as a preacher. He made his reputation, and thrived, on the fervent enthusiasm he stoked in his listeners. That enthusiasm depended upon the principle of immediate gratification, through easily accessible proofs of salvation, that he offered. He could accomplish in minutes what other preachers needed weeks and months to achieve -- and that was a good thing, at least for him, for he was prone to move quickly from community to community.

If the notion of immediate grace in evangelical Protestantism had a polar opposite, it might well be found in the Calvinism of earlier generations. Interestingly, the Calvinist system of predestination and grace was the cause of many doctrinal battles over the notion of proof. In the eighteenth century, "New Divinity" Calvinists such as Jonathan Edwards believed that God had decided, before creating mankind, who would be saved and who would be condemned to eternal damnation. According to this doctrine, there was nothing that those who were damned could do to save themselves. This caused a great deal of debate and unrest among believers over the value of "works" -- the acts of benevolence that strict Calvinists thought could not affect the ultimate destination of a soul. Harriet Beecher Stowe, daughter of the famed New England Congregationalist minister, dramatized the distress that this doctrine provoked in *The Minister's Wooing* (1859). The plot of the novel centers on the family of James Marvyn, a young man believed to be lost at sea. Not knowing whether or not James had received a sign that he had been saved, the family argues through the possibility that, had he not received a sign before dying, his soul would be damned to hell. As Susan K. Harris puts it in her

introduction to the novel, "the constant quibbling about works by the novel's characters reflects the dispute within Calvinism over whether good deeds *might be considered evidence of election*, and if so, what actually might be considered a work."[180] As in later evangelical theology, the notions of proof and evidence of God's will took center stage; but in the novel, that evidence (or the lack thereof), is the source of a great deal of anxiety:

> "Mary," said the Doctor, pushing the papers from him.
>
> "Sir," she answered, looking up, the blood just perceptibly rising in her cheeks.
>
> "Do you ever have any periods in which your evidences seem not altogether clear?"
>
> Nothing could show more forcibly the grave, earnest character of thought in New England at this time than the fact that this use of the term "evidences" had become universally significant and understood as relating to one's right of citizenship in a celestial, invisible commonwealth.[181]

It was exactly this "right of citizenship in a celestial, invisible commonwealth" that evangelical Protestants such as Finney promised worshippers during the Second Great Awakening. For them, as for the character of Candace in Stowe's novel, good works were their own evidence of a saved soul. By the mid-nineteenth century, "evidences"

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[180] Susan K. Harris, "Introduction," in Harriet Beecher Stowe, *The Minister's Wooing*. New York: Penguin, 1999; x. Emphasis added.

[181] Stowe, 167.

might be more strongly identified with science or photography than religion, but the notion of proof retained a connection to the notion of Divine truth. That truth was simply more accessible to a wider populace in the early nineteenth century than it had been in the eighteenth century. Still celestial, but no longer quite as invisible, signs of the Divine Spirit were more easily glimpsed in the visible surfaces (be they aspects of nature or aspects of human beings in the middle of conversion) of the world.

In *A Shopkeeper's Millennium,* Paul E. Johnson makes the important point that Finney manipulated his congregants through every available social means. One of the most important tools in his arsenal was an economic one. Finney worked hard to convert entrepreneurs in the communities in which he preached; those entrepreneurs would then place pressure on their workers to attend revivals. "The most powerful source of the workingman's revival," Johnson writes, "was the simple, coercive fact that wage earners worked for men who insisted on seeing them in church." For many wage-laborers, being seen in church almost literally became a job requirement, for it provided proof to their employers, during a time of revivalist moral reforms, that they lived a God-fearing, temperate life. That many workers internalized this mandate and attended church willingly, Johnson argues, demonstrates the effectiveness of the social controls that evangelical Christianity produced.[182]

Finney's extraordinary success involved a significant amount of showmanship. He understood instinctively that ministers needed to capture and sustain the attention of their audiences, and he designed his services to produce as much drama as possible. Finney's greatest innovation, in this respect, was "the anxious bench" -- a row of seats

[182] Johnson, 109-141.

near the pulpit that was filled by sinners awaiting conversion. During crowded prayer meetings, Finney left nothing to chance; based on information he gained from private meetings, he would arrange for the anxious bench to be occupied by people who were fraught about their sins, and who were already on the verge of conversion. As Paul E. Johnson notes, "none sat on the anxious bench who was not almost certain to fall."[183] The game, in other words, was rigged -- and was set up to excite the emotions of the audience. Finney placed the anxious bench close to the pulpit, and he would preach vociferously and directly at the trembling sinners before him, demanding that they convert immediately when his performance had reached its conclusion.

Finney's preaching, then, was calculated to produce excitement, drama, and suspense. It was based, importantly, on the idea of display. The occupants of the anxious bench served as empirical proof that God's spirit was among the assembled congregants. Faced with the incontrovertible evidence before their eyes -- with those on the anxious bench lined up before them like scientific specimens in a display case -- they found it hard to resist Finney's entreaties. Finney turned acts of conversion, as Paul Johnson points out, into "grand public spectacles," extraordinary social events that hinged on demonstrable proof of salvation and contact with God. Those people whose faith was plagued with doubt could see the leaders of their community falling under Finney's hand. Thanks to Finney, and other evangelical preachers of the time, visual proof of grace became an important part of the act of conversion.

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[183] Johnson, 102.

Emerson and The New Religious Style

Under the hands of evangelical Protestants such as Charles Grandison Finney and Lyman Beecher, the presence of God came to seem more immediately present, more available to Americans in their daily lives. This is not to say that Americans, as a whole, became more religious during this period; it represents, rather, a shift in cultural attitudes: for those who looked for it, signs of divinity were no longer shrouded in the mystery of Calvinist predetermination, but were visible and more freely available in everyday life. In 1830, one convert in Rochester observed that "You could not go upon the streets and hear any conversation, except upon religion."[184] As the growing number of millenarian Christian sects during these decades suggests, it seemed to many Americans that the Day of Reckoning was on its way.

In New England, and in Boston particularly, Unitarianism was the dominant religious force in the antebellum years. Descending partly through eighteenth-century Arminianism, which reacted against the excesses of the First Great Awakening, the Unitarianism of Emerson's Boston was a highly rational faith that eschewed the waves of popular religious enthusiasm that the Second Great Awakening generated. Founded upon the doctrinal belief that of the Father, the Son, and the Holy Ghost, only the Father could be considered God -- and against the Trinitarian belief that all three were manifestations of the same deity -- New England Unitarianism during this period was most prevalent in

[184] Johnson, 95.

the upper classes of Boston.[185] Centered around the Harvard Divinity School, it was strongly tied to the literature and philosophy of its day. Sidney Ahlstrom has noted that the "flowering of New England" described famously by Van Wyck Brooks was "chiefly a flowering of Unitarianism."[186]

Ralph Waldo Emerson was part of that Unitarian flowering for a short time. Ordained as a minister in the Second Church of Boston in 1829, Emerson was, by some accounts, a diffident preacher. His sermons, according to the biographer Robert D. Richardson, Jr., were "profoundly conventional," and he found himself unable to perform some duties of his office.[187] When he visited an old revolutionary war hero who lay on his deathbed, Emerson felt himself at a loss for words; he looked at the bottles of medicine near the man's bed, and began to talk about glassmaking, until the war hero sent him away with the words, "Young man, if you don't know your business, you had better go home."[188] Emerson had been conflicted about entering the church from the start; in a letter to his brother William, he referred to the day of his ordination as his

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[185] Ahlstrom, 479, 485.

[186] Ahlstrom, 483.

[187] Robert D. Richardson, Jr., *Emerson: The Mind on Fire*. Berkeley: University of California Press, 1995; 80. David S. Reynolds suggests that Emerson was not a conventional minister, pointing out that only twenty-five percent of his sermons concerned doctrinal issues, and that he was criticized for his use of imaginative imagery in his addresses. David S. Reynolds, *Beneath the American Renaissance: The Subversive Imagination in the Age of Emerson and Melville*. Cambridge, Mass.: Harvard University Press, 1988; 19.

[188] Richardson, 91

"execution day."[189] Clearly, Emerson felt that the conventions of church theology and practice inhibited his ability to express himself in the terms he desired.

When his beloved wife Ellen died in April of 1831, the twenty-seven year-old Emerson was devastated. But the loss that uprooted his personal and professional life also freed him from the constraints of a conventional existence.[190] Though he threw himself into his work at the Church -- writing and researching a series of lectures on the Gospels -- he began to separate himself, internally, from the job that defined his public life. In 1832, he left the Church over a disagreement about Communion -- Emerson rejected the idea that the fall of Adam and Eve, and the subsequent redemption of mankind by Jesus, defined the heart of Christianity.[191] He submitted a letter to the Church saying that he would no longer perform Communion with the established ceremonies. Although he knew the Church did not want to lose him, he understood that it could not agree to his proposed changes in the service; as he had hoped it would, the Church freed him from the shackles of his job. As Lee Rust Brown has noted, the problem was not with the church, but with Emerson. "His own massive ambitions could never find an outlet within the guidelines of any given profession," Brown writes.[192]

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[189] Richardson, 90.

[190] Richardson, 118.

[191] Richardson, 125. This point of contention, obviously, was not minor.

[192] Lee Rust Brown, *The Emerson Museum: Practical Romanticism and the Pursuit of the Whole*. Cambridge, Mass.: Harvard University Press, 1997; 9.

At the root of Emerson's disagreement with the Church was what Richardson calls "a powerful craving for direct, person, unmediated experience."[193] Emerson did not want to spend his life repeating dry rituals that had been handed down to him by centuries of theological convention. He wanted to find extraordinary meaning in the present moment, "a religion by revelation to us, and not the history of theirs," as he described it later in *Nature*.[194] Richardson memorably ascribes Emerson's act of opening his wife's coffin, more than a year after her burial, to this impulse.[195] He wanted to face life and death directly, without mediation. Both ecclesiastical and social conventions stood between him and the direct experience he craved.

In *Beneath the American Renaissance,* David S. Reynolds argues that the new, folksy style of revivalist preaching described earlier in this chapter influenced Emerson's mature writing in hitherto unrecognized ways.[196] The primary figure of influence on Emerson, in this regard, was Father Taylor, the Boston Methodist preacher who served as the model for Father Mapple in Melville's *Moby-Dick.* Emerson often attended Taylor's services at the Seamen's Bethel Church, and even preached a few sermons there. Taylor spoke with dazzling rhetorical skill, couching his sermons in colloquial language and punctuating them with images -- usually drawn from the seafaring life with which his audience was familiar -- that struck his listeners with enormous force. Whitman called

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[193] Richardson, 3.

[194] Ralph Waldo Emerson, *The Collected Works of Ralph Waldo Emerson, Volume 1: Nature, Addresses, and Lectures*. Ed. Alfred R. Ferguson, Introduction and Notes by Robert E. Spiller. Cambridge, Mass.: The Belknap Press of Harvard University Press, 1971; 7.

[195] Richardson, 3.

[196] Reynolds, 19-21.

him the only "essentially perfect orator" in the United States; Emerson wrote that Taylor "rolls the world into a ball & tosses it from hand to hand."[197] An article about Taylor that appeared in an 1846 issue of the *Boston Daily Star* described the power of his speech:

> He always preaches extemporaneously, and his style is like nobody's else. To form anything like a correct conception of it, one must hear for himself; it is not in the power of man to convey it on paper. He is gentle, pathetic, and persuasive; abrupt, sublime, and thrilling; now melting the hearts of his hearers with touching pathos, and anon arousing them with solemn warning. His abilities seem to be all natural, for he pays little or no regard to grammatical or rhetorical rules, and yet his language is, in the main, correct; and his figures are surprisingly appropriate and graphic.[198]

The newspaper's description of Taylor's rhetorical style as "graphic" seems to buttress one of the points Reynolds makes about the changing religious style of the antebellum period. Reynolds argues that, in addition to informal language, Taylor and other revivalists of the Second Great Awakening filled their sermons with narrative, illustration, and imaginative storytelling. The use of powerful images in sermons had long been a characteristic mark of American religious style, but evangelical preachers of the early nineteenth century took the practice to new heights, and those who heard them noticed. One Virginia Baptist preacher was commended for "*stringing together picture*

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[197] Reynolds, 20, 21.

[198] Quoted in Wesley T. Mott, "The Eloquence of Father Taylor: A Rare 1846 Eyewitness Report." *The New England Quarterly*, Vol. 70, No. 1. (Mar., 1997): 102-113; 106.

after picture," while Emerson himself approved of the "daring imagery" of Edward Everett, the great Unitarian minister.[199]

For Reynolds, the difference between the older religious style and the new one pioneered during the Second Great Awakening can be characterized as a movement from "the doctrinal to the imaginative."[200] Certainly, the "images" and "pictures" that so enthralled these listeners were not pictorial objects in a literal sense, but rather were pictures created in the listener's minds by words they heard spoken. It seems more than coincidental, however, that this new emphasis on verbal images and metaphors in religious sermons took place at the same time that, as the religious scholar David Morgan has shown,[201] a number of evangelical sects began to use illustrations more frequently in their Bibles, tracts, broadsides, and pamphlets. This practice was especially widespread in millennial groups who believed that the apocalypse was approaching rapidly. The Millerites, for instance, who followed the teachings of Adventist preacher William Miller, believed that Christ would return to the earth in 1843. In their effort to convey this coming revelation to as many people as possible as quickly as possible, they utilized new visual technologies of the 1820s and 1830s to add religious illustrations and charts to their publications. These illustrations had the advantage of communicating religious belief quickly and effectively; even those who could not read, or were at a low level of literacy, could understand visual depictions. Advances in printing helped disseminate such images in the emerging mass culture of the 1830s. As Morgan writes, "seeing was

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[199] Reynolds, 18, 19.

[200] Reynolds, 15.

[201] See David Morgan, *Protestants and Pictures: Religion, Visual Culture, and the Age of American Mass Production.* New York: Oxford University Press, 1999.

believing, and mass culture only meant more ways of believing, or doing so on a grander scale."[202] The American Tract Society, too, used a growing number of illustrations in its texts. Members of the society, like Charles Grandison Finney, wanted to have the ability to educate and convert people immediately; illustrations gave them that opportunity. "The modern age of advertising," Morgan writes, "with its transient claims on consciousness in the form of brief messages wrapped in bold imagery took shape in evangelical mission efforts to convert the gospel into graphic information for mass dissemination."

In tandem with the visually oriented, or imaginative, preaching of evangelical ministers such as Father Taylor, the entrance of theological imagery into American mass culture of the 1820s and 30s forms the religious backdrop against which Emerson wrote *Nature* (1836). Another part of that backdrop was Emerson's interest in natural history and science -- an interest that dominated his reading in the years after he left the ministry. If the main focus of this dissertation has been on the ways in which religious and scientific discourses concentrated attention on the role of empirical evidence -- which increasingly took the form of *visual* evidence -- in proving or disproving the truth of an idea, it is interesting to note that these same currents of thought came together in Emerson's work, as well. And perhaps not surprisingly, the book that emerged from those twined interests prefigured photography in important ways.

The Transparent Seer

[202] Morgan, 39. Emphasis added.

It has long been noted that metaphors of vision permeate Emerson's writing. Whether one considers the most famous instance of this metaphor -- the "transcendent eyeball" passage in *Nature* -- or another of Emerson's incisive essays, it is clear that Emerson regarded the eye as a human being's first level of engagement with the external world. As he wrote in "Circles," "The eye is the first circle; the horizon which it forms is the second; and throughout nature this primary figure is repeated without end."[203] It's important to note that the second figure in this "primary" relationship is not a simple, external horizon. Rather, the horizon in question is one that is created --and limited -- by the very eye that perceives it. The extent to which a man or woman can see the world helps define his or her relationship to it. Emerson put this idealist notion of subjectivity another way, and also tied it to the trope of sight, in "Experience." Writing out of the pain of his son Waldo's death, Emerson noted the ways in which a person's moods can affect the way that he or she sees the world:

> Life is a train of moods like a string of beads, and as we pass through them they prove to be many-colored lenses which paint the world their own hue, and each shows only what lies in focus. From the mountain you see the mountain. We animate what we can, and we see only what we animate. Nature and books belong to the eyes that see them. It depends on the mood of the man whether he shall see the sunset or the fine poem. (30)

[203] Emerson, *Collected Works*, Vol. II, 179.

One might expect that the loss of his son would have darkened Emerson's vision, but he characteristically grabbed hold of the subjective nature of the world, as he had described it, and empowered himself to overcome his grief. But the greatest tragedy, for Emerson, was that even this unimaginable pain could not bring him closer to the realities of the world:

> People grieve and bemoan themselves, but it is not half so bad with them as they say. There are moods in which we court suffering, in the hope that here, at least, we shall find reality, sharp peaks and edges of truth. But it turns out to be scene-painting and counterfeit. The only thing grief has taught me, is to know how shallow it is. That, like all the rest, plays about the surface, and never introduces me into the reality, for contact with which, we would pay the costly price of sons and lovers. (29)

Like Ahab in Melville's *Moby-Dick*, who would sacrifice his own life, and the lives of his crewmates, to strike through the veil of outward appearances and reach the core of reality it obscured,[204] Emerson suggests darkly that he would pay any price, even that "of sons and lovers," for a glance at the "sharp peaks and edges of truth." But it is not to be; even the most painful of losses leaves him casting about the surfaces of life, skimming his metaphysical craft on top of, rather than through, the deep waters.

Emerson's frustration with the superficiality of appearances drove him, throughout his life, to seek out intense experiences of the eye and the mind. As

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[204] Herman Melville, *Moby-Dick*. 1851. New York: Norton, 1967; 144.

mentioned earlier, it was this urge to confront the universe head-on that led him to open his wife's coffin a year after she had died; it was this impulse that led him, in his most famous work, to urge his fellow citizens to "behold God and nature face to face."[205] For Emerson, that confrontation with God and nature, with all that was part and parcel of "an original relation to the universe," was profoundly visual in nature: he wished to *behold* God and nature face to face, not "through their eyes," but through his own; to be the poet, "whose *eye* can integrate all parts"; to "*see* all" from the position of the transparent eyeball.[206] Indeed, the one qualification he put upon the transcendent eyeball passage was that nature could repair any disgrace or calamity save one which took his eyes (10).

For Emerson, sight was not just a metaphor or trope -- it was a health issue. In 1825, he suffered from an eye disease that nearly blinded him. As he struggled with his doubts about the Unitarian Church, his eyesight failed him, not insignificantly, as he was writing an essay on "The Unity of God." Emerson had two surgeries performed on his eyes, one of which involved the puncturing of his cornea; the operations, in collusion with a period of rest that he took on an uncle's farm, restored his sight.[207] But Emerson would always be acutely aware of the importance of vision. As he quite literally looked at the world with new eyes, Emerson strove to look past the surfaces, through the pasteboard masks that so frustrated Ahab. But where Ahab feared that there was "naught beyond" the mask -- or worse, that the painted surfaces of Nature merely concealed "the

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[205] Emerson, *Collected Works*, Vol. I, 7. Further citations shall appear in the text.

[206] Emphasis added.

[207] Richardson, 63.

charnel-house within" [208] -- Emerson believed that a true vision of nature would be redemptive. He had faith that such a look could occur in the present; and he was sure that only religions and philosophies which could find such revelations in the current moment, rather than among the ruins of the past, were worthy of his belief.

I wish to concentrate on *Nature* (1836) not only because it helps locate the sense of vision at the center of Emerson's thought, but also because it illustrates, in important ways, exactly how Americans came to expect, desire, and theorize the photographic camera even before it had been invented. Conditioned by decades of argument over the role of empirical evidence in scientific and religious discourse, Americans yearned for a new kind of vision that, like Emerson's transcendent eyeball, could see through the clutter of contemporary life and provide an image of nature unblemished by subjectivity . This was particularly true for Americans of Emerson's generation, who had been born after the American Revolution, and who sought, like him, a direct experience of the world that could rival the experiences of their forebears. But it is this kind of retrospective look at the past that Emerson disdained in the opening pages of *Nature*. Rather than recounting tales of others who have "beheld God and nature face to face," Emerson asserted that "The sun shines to-day also," and urged his fellow citizens to "demand our own works and laws and worship" (7). Revelation, in other words, was available in the present if only it could be glimpsed:

> To speak truly, few adult persons can see nature. Most persons do not see the sun. At least they have a very superficial seeing. The sun illuminates

[208] Melville, 144, 170.

> only the eye of the man, but shines into the eye and heart of the child. The lover of nature is he whose inward and outward senses are still truly adjusted to each other . . . (9)

Emerson searches for a deeper kind of seeing than the "superficial" vision that is more common among his peers. The child-like vision that he lauds is one that is completely open -- the child's heart and mind are exposed to the world, while the adult's senses are partially shrouded by the detritus of experience. Seeing nature, in Emerson's formulation, requires a completely receptive, almost amoral, sense of vision.

Later in the same paragraph, Emerson arrives at the fully articulated figure of this vision in the form of the transcendent eyeball. With a series of dependent clauses, Emerson creates a rhythm that builds slowly before rushing towards a transcendent crescendo:

> Crossing a bare common, in snow puddles, at twilight, under a clouded sky, without having in my thoughts any occurrence of special good fortune, I have enjoyed a perfect exhilaration. In the woods, too, a man casts off his years, as the snake his slough, and at what period soever of life, is always a child. In the woods, is perpetual youth. Within these plantations of God, a decorum and sanctity reign . . . In the woods, we return to reason and faith. There I feel that nothing can befall me in life, -- no disgrace, no calamity, (leaving me my eyes,) which nature cannot repair. Standing on the bare ground, -- my head bathed by the blithe air,

> and uplifted into infinite space, -- all mean egotism vanishes. I become a transparent eye-ball. I am nothing. I see all. The currents of the Universal Being circulate through me; I am part or particle of God. (10)

Emerson's transcendence is one in which body and mind are united with nature through the power of vision. Uplifted into the air, Emerson himself *becomes* an instrument of perfect vision, a transparent cipher through which "the currents of the Universal Being" flow. The notion of transparency is key, for it is the absence of subjectivity, the absence of the adult persona described earlier in the paragraph, that allows Emerson to achieve unity with nature.

In his provocative book, *The Emerson Museum*, Lee Rust Brown makes an argument about Emerson's notion of transparency that, despite its many insights, is a case study in the need for a project, such as this dissertation, that connects antebellum literary thought to concurrent discourses in religion, science, and photography. Before I explain why that is the case, a summary of Brown's argument is in order. In the first chapter of the book, "Ruins in the Eye," Brown uses the writing of Leonardi Da Vinci to make the case that Emerson's metaphor of transparency is, according to the laws of optics, physiologically impossible:

> Transparency manifests itself only as an attribute of the medium lying between two discontinuous realms: the opaque eyeball that beholds and the opaque surface that appears "behind" or "on the other side of" the transparent medium. Moreover, the phenomenon of transparency becomes

> impossible in the absence of either or both of these two discontinuous realms. In theory and in experience there is no transparency without some contiguous opacity. Something in particular always appears beyond the medium, for the essence of the transparent medium is to be between two things.[209]

Emerson's eyeball, in other words, cannot be both transparent and all-seeing. For it to be transparent, it would have to be wholly translucent -- one would have to be able to see *through* it. But the mechanics of sight dictate that light entering the eye be projected onto a retina-like screen in order to be grasped by the mind. Such a screen could not possibly be translucent; if it were, it would not be capable of reflecting images projected upon it. According to Brown, the dependence of vision on a retina-like surface would preclude the transparency that Emerson describes.

Even as Brown acknowledges the dangers of taking Emerson too literally -- "complex metaphors make complex arguments," he writes -- he proceeds to take Emerson too literally:

> The Emersonian eyeball, like Leonardo's angel, lacks the interior opacity requisite for vision. Its ability to see becomes even more inconceivable in light of the fact that what surrounds the eyeball, "infinite space," is identical in its transparency to the inner space the eyeball encloses.[210]

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[209] Brown, 43.

[210] Brown, 44.

Brown's purpose in meticulously dissecting Emerson's "ocular allegory" is to open up space for his own metaphorical ruminations on Emerson's sense of vision. Lurking just beyond Brown's arguments, but never mentioned in them, is the idea of the transparent eyeball as camera. As I will suggest, it is exactly that photographic mode of seeing that best exemplifies the transparent, bodiless mode of vision that Emerson describes.

Such a suggestion might provoke an objection from Brown that a camera lens is even less transparent than Emerson's hypothetical eyeball. After all, Emerson's figure was pure construct, while cameras are physical objects whose material natures are not under dispute. It would be fruitless to quibble with the common-sense truth of this objection, but the objection itself points us towards the very phenomenon that lies at the heart of this dissertation: despite its obvious materiality, and the easily glimpsed ways in which a piece of glass can distort a view, the camera seemed to negate itself in much the same way that Emerson's body was erased during his transcendent moment. In the popular imagination, if not in material fact, the camera lens *seemed* to be a transparent object that imposed no opaqueness between itself and the light that passed through it. It was, as Daguerre wrote memorably in his announcement of his invention, "not merely an instrument which serves to draw Nature; on the contrary it is a chemical and physical process which gives her the power to reproduce herself."[211]

Thus, Emerson's figure of the transparent eyeball captures one of the most powerful tropes surrounding the camera after its invention. Emerson writes in *Nature* that at the crucial moment in which he becomes the transparent eyeball, "all mean

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[211] Louis Jacques Mandé Daguerre, "Daguerreotype," in *Classic Essays on Photography*, ed. Alan Trachtenberg. New Haven, Conn.: Leete's Island Books, 1980; 13.

egotism vanishes" (10). At the crucial moment of transfiguration, the thinking, egocentric self that is Ralph Waldo Emerson is absorbed into the greater power of Universal Being. This self-negation is an erasure of personality. More crucially, it is an erasure of human fallibility, a melding of metaphysical substances in which all possible errors of vision -- all defects in the eye, all biases that could affect the mind that interprets the images passing through it -- are wiped clean and rendered wholly translucent. Emerson's milky cataracts clear, and his vision along with it, because he is no longer seeing through his own eyes. His eyes are no longer his -- they belong to the universe, and he along with them.

Two years after the daguerreotype reached American shores, Emerson described the photographic process in terms reminiscent of the transparent eyeball. In a journal entry on October 9, 1841, he wrote:

> The Daguerreotype is good for its authenticity. No man quarrels with his shadow, nor will he with his miniature when the sun was the painter. Here is no interference, and the distortions are not the blunders of an artist, but only those of motion, imperfect light, and the like.[212]

Like a transcendent eyeball, the camera through which the daguerreotype image is created imposes no "distortions" or "blunders" upon its subjects. The sun itself, rather

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[212] Ralph Waldo Emerson, *Journals of Ralph Waldo Emerson*, ed. Edward Waldo Emerson and Waldo Emerson Forbes. New York : Houghton Mifflin; Cambridge : Riverside Press, 1911; 87.

than a camera or a set of photo-sensitive chemicals, seemed to produce an image on the photographic plate. And in the process, the camera seemed as natural as a shadow.

This description of photography as sun-painting was a dominant trope in early discussions of photography. Americans who wrote about the medium repeatedly emphasized that the camera's vision was more perfect than that of the human eye; that it was the sun itself, rather than the camera, which produced daguerreotyped images; that such images were accurate, unbiased, and objective because of the perceived absence of human interference and because the technology itself was self-abnegating and self-naturalizing. This interpretation of photography, and the negation of the photographic apparatus, was made possible by the scientific and religious discourses described in this and previous chapters. Scientific discourse conditioned Americans to believe that empirical evidence was the highest form of proof; evangelical theology democratized grace and made it available in the present moment; revivalist preachers emphasized the visual proof of grace; and natural theology led Americans to believe that God's will was written on the visible surfaces of the world. For years, theologians such as Edward Hitchcock had suggested that humans moved always "within the circle of Omniscience." Soon, they would think that they had proof of it.

Chapter 4

Transcendent Impressions: The Camera as the Eye of God

> "For, in truth, the Daguerreotyped plate is infinitely (we use the term advisedly) is *infinitely* more accurate in its representation than any painting by human hands. If we examine a work of art, by means of a powerful microscope, all traces of resemblance to nature will disappear -- but the closest scrutiny of the photogenic drawing discloses only a more absolute truth, a more perfect identity of aspect with the thing represented. The variations of shade, and the gradations of both linear and aerial perspective are those of truth itself in the supremeness of its perfection."
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> — Edgar Allan Poe, "The Daguerreotype," *Alexander's Weekly Messenger* (1840)

> "Seeing is believing and certain things must be seen to have been done. Without the camera, we might start to disbelieve."
>
> — Graham Swift, *Out of This World* (1988)

In 1864, the Reverend H. J. Morton, D.D., published in *The Philadelphia Photographer* an essay about the objectivity of the camera. Morton was a frequent contributor to the magazine, whose motto was "The only journal in America in sympathy with the working photographer!" True to that description, most articles in the journal

offered practical advice on chemicals, lenses, and equipment that would interest active photographers. Morton was one of the few contributors to write more speculative pieces on the significance and meaning of photography during its third decade, a period in which technological advancements transformed the medium. Like a surprising number of nineteenth-century Americans who wrote about photography, Morton had a religious vocation: he served as an Episcopalian minister at the St. James Church in Philadelphia, and he received a Doctorate in Divinity from the University of Pennsylvania.[213]

In the essay, "Photography as an Authority,"[214] Morton argued that the camera provided a new and convincing answer to the classical Roman inquiry, "What is truth?" Morton contended that, had the Roman asked the same question in 1864, "his own observation might have told him, that 'truth' so far as the representation of spiritual things was concerned, might be found in the word of God; in regard to material things, in Photography" (180). Morton did not go so far as to claim that the camera was capable of superseding the word of God; but it seemed to him that photography offered the most telling and truthful glimpse into the heart of God's material creation. Given the rhetoric of natural theology, which posited that God's will could be seen in the visible surfaces of the world, such vision was akin to seeing through divine eyes.

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[213] Biographical information about Morton can be found in Rev. S.F. Hotchkin, "Early Clergy of Pennsylvania and Delaware." Philadelphia: P. W. Ziegler & Co., 1890; 156-8. Selections from this text are available online: March 31, 2006. <http://www.rootsweb.com/~usgenweb/pa/1pa/1picts/hotchkin/early-clergy.htm>

[214] Rev. H. J. Morton, D.D., "Photography as an Authority," *The Philadelphia Photographer*, Vol. 1, No. 12 (Dec., 1864): 180-183. *The Philadelphia Photographer* was the official journal of the National Photographic Association of the United States, and was published in Philadelphia between 1864 and 1885 by Benerman & Wilson, Publishers. Further citations will be noted parenthetically in the text.

Morton made this connection more explicit in his next few paragraphs, which expressed some of the most striking sentiments about photography in nineteenth-century America, particularly in regard to its relationship to proof:

> The experience of humanity for eighteen hundred years has set its seal to the grand declaration uttered eighteen hundred years ago, “Thy word is truth;” and every day and hour since the wonderful art of Photography has been invented, brings new proofs of *its* veracity.
>
> What we want in a witness are capacity and opportunity for accurate observation, and entire honesty. Now the camera of the Photographer has exactly these qualifications. To exquisite acuteness of vision and instantaneous comprehension of minutest details, it adds perfect freedom from all partiality and hypocrisy. It sees everything, and it represents just what it sees. It has an eye that cannot be deceived, and a fidelity that cannot be corrupted. We have abundant ocular delusions, but the camera is never under any hallucination. Behind the most accurate human eye there is often a very prejudiced human mind, refracting its vision . . . . But the camera’s eye of microscopic minuteness and exactness of vision, has behind it a crystal plate that has no partiality, and the fingers of the sun that paint the pictures which that crystal surface bears, are vibrations from a great burning heart that throbs with no human passions. Hence the camera seeing with perfect accuracy and microscopic minuteness, and

> representing with absolute fidelity, is a witness on whose testimony the most certain conclusions may be confidently founded. (180-1)

Perhaps never before or since has anyone articulated, with such enthusiasm and verve, the ostensibly objective nature of the camera. Though Morton's words seem replete with hyperbole, it is hard to find any sense of irony behind his characterization of the medium. If Emerson's transcendent eyeball prophesied the rise of a totalizing vision freed of distortions imposed by the human eye, Morton described the material fulfillment of that vision. In his view, the camera, like Emerson at his moment of transcendence, becomes "part or particle of God," a transparent cipher through which the currents of Universal Being flow directly from the heavens to the earth.

Alan Trachtenberg has observed that in the passage above, Morton presents the camera "as the eye of God." "It is hard to imagine," Trachtenberg writes, "a stronger, more fervent evangelical expression of the idea of the camera's infallibility."[215] Trachtenberg's use of the word "evangelical" in this context should not surprise us: beyond the fact that Morton was a minister, Morton's utilization of religious rhetoric to describe the camera makes sense when it is contextualized by what I have described in this dissertation as the emerging "culture of proof" in nineteenth-century America. Empirical evidence had become the basis of scientific progress and argument, and theologians had begun to rely upon it to prove the existence of God and to find evidence of grace in their parishioners. Institutional religion itself had become democratized,

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[215] Alan Trachtenberg, "Photography: The Emergence of a Keyword" in *Photography in Nineteenth-Century America*, ed. Martha A Sandweiss. New York: Harry Abrams, 1991: 17-47; 18.

moving from the church to the campground; God's providential design, natural theologians believed, could be seen in the surfaces of Nature. And, at that crucial moment, the camera appeared in America, offering startlingly clear views of the universe. Daguerreotypes became the material fulfillment of the culture of proof, re-inscribing the promise of Winthrop's "city upon a hill" for a new generation. In the figure of the camera, disparate scientific and religious ideas were fused into a single discourse of proof that gave a convincing answer to those seeking to understand the nature of truth in a rapidly modernizing world.

In the final chapter of this dissertation, I consider in detail the early reaction to photography. I argue that when Americans looked at daguerreotypes, they reacted to them not just as pictorial objects, but also as pieces of empirical proof at a time when many trusted sources of proof had become compromised. As the church began to play a diminished role in the everyday lives of Americans -- and as the sense of reassurance that the Church had provided previously began to dissipate -- daguerreotypes gave hope of metaphysical stability. Just as biblical criticism and geological science had begun to cast doubts upon the reliability of the Bible, daguerreotypes offered reassurance that the universe had indeed been designed by a higher power. Americans reacted so strongly to photography not only because the pictures themselves were so beautiful and so novel, but also because photographs seemed to resolve metaphysical doubts about the existence of divine intention. In short, photography gave Americans something to believe in just as they had come to doubt belief itself.

As we shall see in this chapter, H. J. Morton was far from the only commentator on photography to ascribe religious meaning to the photographic medium. Through a

survey of early American reactions to photography, I shall demonstrate that this was indeed a common paradigm through which early photography was understood. Since so much of this dissertation has rested upon the so-far unproven contention that religious tropes permeated early writing on photography, I shall devote a considerable portion of the chapter to such rhetoric. The chapter will close with a reading of mid-nineteenth century scientific texts that explicitly placed photography within scientific and religious rubrics of proof -- and found within it an antidote to the nineteenth-century crisis of doubt.

A Short History of the Medium

Before exploring reactions to photographic technologies, it would be prudent to provide a thumbnail history of the daguerreotype, which was the major picture-making technology in America until the mid-to-late 1850s. Although it is tempting to think of the daguerreotype as a direct precursor of the modern photograph, the history of the medium reveals a more complicated story.[216] When the invention of photography was announced to the world in 1839, the daguerreotype was one of a number of competing photographic technologies. And in fact, the modern photograph descended not from the daguerreotype, but from what was called the calotype, a picture-making technology developed in Britain

[216] For a recent re-examination of the early history of photography, see Geoffrey Batchen, *Burning With Desire: The Conception of Photography*. Cambridge, Mass.: The MIT Press, 1997.

by William Henry Fox Talbot.[217] While daguerreotypes were one-of-a-kind, positive images that could not be reproduced and that were made using expensive copper plates coated with silver halide and developed over mercury fumes, calotypes were reproducible, negative-positive, paper prints. Daguerreotypes, however, produced much finer gradations of tone and detail than the calotype. As a photographic practice, daguerreotypy grew more quickly in popularity in part because it produced more detailed images, and in part because Talbot restricted the spread of his technology by holding onto his patent license.[218] Daguerre, meanwhile, sold his patent to the French public in exchange for a lifetime pension from the government, but held on to his patent rights in Britain.

Soon after the French government announced the discovery of the daguerreotype, waves of enthusiasm greeted the new technology. Some historians have compared the exhilaration surrounding this moment to the landing of the first astronauts on the moon in 1969.[219] In America, especially, the daguerreotype achieved its most spectacular success.

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[217] Joel Snyder, "Inventing Photography," in Greenough, Sarah and Snyder, Joel, *On the Art of Fixing a Shadow: One Hundred and Fifty Years of Photography*. Washington, D.C. : National Gallery of Art ; Chicago : Art Institute of Chicago, 1989: 3-38; 11.

[218] In *A World History of Photography*, Naomi Rosenblum writes: "In 1841, Talbot took out the first of his patents, using the word calotype to describe the resulting image, which he also referred to as a Talbotype. This action initiated a ten-year period during which English scientific and artistic endeavor in photography became entangled in problems of commercial exploitation. Both during his lifetime and long afterward, Talbot was accused of obstructing the development of photography because of his intransigence with regard to the four patents he held on the calotyping process." Naomi Rosenblum, *A World History of Photography* (Third Edition). New York: Abbeville Press, 1997; 29.

[219] Jean-Claude Lemagny and André Rouillé, eds. *A History of Photography*. Trans. by Janet Lloyd. New York: Cambridge University Press, 1987; 20.

Historians report that by 1841, almost every town either had its own studio or was visited by traveling photographers.[220]

When Daguerre announced his invention, he thought that it would have the greatest impact on scientists and artists, although he allowed that "*even* portraits will be made, though the unsteadiness of the model presents, it is true, some difficulties [which need to be overcome] in order to succeed completely."[221] Despite Daguerre's initial prediction, however, it was as a portrait-making medium that daguerreotypy flourished. Patent offices were flooded with technical innovations, and by 1843, photographers had reduced the necessary exposure time from a range of three to thirty minutes to a range of one to two minutes, depending on the lighting conditions.[222] In America, daguerreotype portraits quickly replaced miniature painted portraits, which had long dominated the market. Daguerreotypists often advertised their plates as "miniatures by the daguerreotype process."[223] Indeed, daguerreotype portraits quickly adopted the sorts of poses common in lithography and steel engravings.[224]

The spread of daguerreotype portraits in America heralded more than just a change in portrait equipment -- it altered the way that Americans saw themselves. Building upon phrenological models, some photographers created systems premised on the assumption that exterior looks revealed the inner character. Photographers sometimes

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[220] Lemagny and Rouillé, 22.

[221] Louis Daguerre, "Daguerreotype," in *Classic Essays on Photography*, ed. Alan Trachtenberg. New Haven: Leete's Island Books, 1980, 11-13; 12. Emphasis added.

[222] Lemagny and Rouillé, 24.

[223] Snyder, 14.

[224] Snyder, 14.

posed their subjects according to their professions -- doctors were expected to hold a certain pose, while lawyers were expected to hold another. Each sitter embodied and performed the essence of his social role, both creating and reinforcing social and visual codes.[225] And as Americans from variegated socio-economic backgrounds posed for daguerreotypes, that experience began to transform personal identity in America.[226] As Alan Trachtenberg writes:

> The near-universality of the experience of sitting for one's daguerreotype circulated throughout America a new regard for visibility, for one's own image as a medium of self-presentation. The millions of surviving daguerreotypes, mostly unidentified by maker or sitter, show people learning a new way of seeing themselves in the eyes of others, seeing oneself as an image.[227]

As pointed out in Chapter Three, a pre-photographic source for the "new regard for visibility" was the evolving evangelical religious ceremony, which increasingly relied on visual proof of grace. But Trachtenberg is right that daguerreotypes intensified the experience of visibility as the new medium forced Americans to come to terms with the faces they presented to the world .

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[225] Alan Trachtenberg, *Reading American Photographs: Images as History, Matthew Brady to Walker Evans*. New York: Noonday, 1989: 28.

[226] See Linda Haverty Rugg, *Picturing Ourselves: Photography & Autobiography* (Chicago: University of Chicago Press, 1997) and Ed Folsom, *Walt Whitman's Native Representations* (New York: Cambridge University Press, 1994): 127-177.

[227] Trachtenberg, *RAP*, 29.

In *The House of the Seven Gables* (1851), Nathaniel Hawthorne dramatized the anxiety and self-consciousness felt by those who sat before the camera. When that novel's protagonist, the daguerreotypist Holgrave, meets his love-interest, Phoebe Pyncheon, for the first time, he offers to show her some specimens of his art. Phoebe demurs, saying:

> I don't much like pictures of that sort—they are so hard and stern; besides dodging away from the eye, and trying to escape altogether. They are conscious of looking very unamiable, I suppose, and therefore hate to be seen.[228]

The image that Phoebe reacts against is that of her cousin, the duplicitous Judge Pyncheon. Her aversion to his daguerreotyped image has something to do with Hawthorne's desire to highlight her intuitively good moral nature, but it also reflects two important facts about the daguerreotype: that the polished, mirror-like plate upon which the image was impressed caused it to flicker or to disappear when tilted; and that, because of the exposure time needed to produce the picture, most daguerreotypes showed people staring stiffly at the camera with tight-lipped concentration -- or perhaps consternation.[229]

Holgrave tells Phoebe that his job consists of "mak[ing] pictures out of sunshine." He explains that he has been trying, without success, to produce a flattering image of Judge Pyncheon:

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[228] Nathaniel Hawthorne, *The House of the Seven Gables*, ed. Seymour L. Gross. New York: Norton, 1967; 91. Further citations will appear parenthetically within the text.

[229] Trachtenberg, *RAP*, 23.

> There is a wonderful insight in heaven's broad and simple sunshine. While we give it credit only for depicting the merest surface, it actually brings out the secret character with a truth that no painter would ever venture upon, even could he detect it. There is at least no flattery in my humble line of art. (91)

Holgrave's comment forms a neat analogue, in the human realm, to the view of nature espoused by natural theologians -- namely, that the visible surfaces of the world disclose its deeper structure, if only viewed through the right lens. For Holgrave, as for countless Americans, the daguerreotype camera made that lens a part of material reality. Because the picture was created not by human hands, but by "heaven's broad and simple sunshine," it had the power to reveal the truth of human nature, to cut through the artifice of self-presentation. Indeed, in *The House of the Seven Gables*, Hawthorne deliberately contrasts the truth-telling daguerreotype portraits of Judge Pyncheon, which depict him as the villain that he is, with the painted portraits of him, in which the artist's hand added the kind of flattery to which the camera was immune.[230]

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[230] In her provocative reading of gender, race, class, and visuality in *The House of the Seven Gables*, Shawn Michelle Smith argues that "in Hawthorne's text, the gaze functions as a weapon in battles of class prerogative, posed first as an aristocratic privilege usurped by artisanal challenges . . . Holgrave's prosthetic vision serves as a vehicle toward a middle-class 'cure' for class antitheses in Hathorne's text; however, as an heirloom inherited from Matthew Maule, Holgrave's supernatural vision is posed as a potentially dangerous power. According to the logic of Hawthorne's middle-class romance, Holgrave must utilize his gaze not only to disrupt class hierarchies (like Maule) but also to reconstitute them in gendered middle-class forms." Shawn Michelle Smith, *American Archives: Gender, Race, and Class in Visual Culture*. Princeton: Princeton U.P., 1999; 19.

Like H. J. Morton, who similarly characterized photographs as the work of the sun, Hawthorne's protagonist describes the camera in terms that betray a notable absence of human agency. For Morton and Holgrave, the camera was a transparent cipher for "the fingers of the sun"; it was those fingers, rather than those of the photographer, which "paint[ed] the pictures which the crystal surface bears." This conception of photography reflects a common idea of the time. Photographs became known as "sun-pictures"; Oliver Wendell Holmes published articles about photography in the *Atlantic Monthly* with titles such as "Sun-Painting and Sun-Sculpture" and "Doings of the Sunbeam."[231] William Henry Fox Talbot famously called his invention "The Pencil of Nature." Walt Whitman referred to photographers as "priests of the sun."[232] Photographs, seen through a divine eye, and produced by a divine hand, were the work of the sun. God himself seemed to authorize the authenticity of the camera's images. In the process, the human fingers that framed the shots, prepared the plates, and exposed the photo-sensitive chemicals to light were effectively erased from the process.

As the following section will show, such conceptions of photography were common soon after the invention of the medium. The urge to ascribe deific properties to the vision of the camera, I suggest, may have resulted from the fact that daguerreotypes answered a variety of cultural needs of the era: at a time when the existence of God was in doubt, daguerreotypes provided evidence that the universe had been designed providentially; just as scientists and theologians began to search for empirical proof to bolster their arguments, the camera arrived to supply it; and finally, at a time when the

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[231] See Oliver Wendell Holmes, "Sun-Painting and Sun-Sculpture," *Atlantic Monthly* (July 1861): 13-29 and "Doings of the Sunbeam," *Atlantic Monthly* (July 1863): 1-15.

[232] Folsom, 105.

old verities, reassurances, and stability provided by the town church as the epicenter of American life began to falter, the camera provided, as H. J. Morton claimed, a powerful answer to the question, "What is truth?"

The Camera as the Eye of God

Early descriptions of the camera often employed religious concepts and terms to describe both the photographic apparatus and the pictures it produced. Generally speaking, these descriptions can be divided into two discursive groups: those which explicitly used religious terminology, and those which conflated quasi-religious concepts with Nature (with an emphatically capitalized N). As my previous discussion of natural theology suggests, these two categories were close in spirit: the writers who commented on the camera's power to give agency to Nature did so at a time when it was believed that Nature derived its power through God's design. Douglas Nickel has noted that "the trope that connects light, shadows, the sun, and Christianity in the Romantic period was readily summoned for the purposes of constructing photography's authority in its first decade."[233] Nickel cites illustrations in the popular press depicting the sun as a painter, as well as this statement, from a promotional label on a French daguerreotype:

> This image, which fixes on a mirror the shadow itself of the sitter, preserving their very smile, their exact glance -- is it not to our eyes

[233] Douglas R. Nickel, "Talbot's Natural Magic," *History of Photography*, Vol. 26, No. 2 (Summer 2002): 132-140; 136.

> sweeter, more sacred than a work on canvas? A miniature is the work of a painter -- **the daguerrean proof is the work of God**. How much more would it be cherished by a parent, or a friend, for it is the reflection of the shadow, the thought, the deeds of the sitter's soul united with God by the power of light.[234]

The promise of the new medium could not have been articulated in stronger terms: daguerreotypes would allow people to see themselves as they were seen through divine eyes; "united with God by the power of light," they would behold themselves truly for perhaps the first time. The number of commentators who used similarly religious rhetoric to describe the camera is too great for a comprehensive survey, but the following examples will convey the extent to which religious terms populated early discussions of photography.

Before a divine origin could be ascribed to the vision of the camera, photography had to be removed, rhetorically, from the realm of human agency. Daguerre's famous 1839 announcement of the photographic objects that would take on his name conveyed both the technological details of his process and the possible uses to which it could be put. Even as he described his process, Daguerre minimized the human role in it:

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[234] Robert Flynn Johnson and Robert Harshorn Shimshak, *The Power of Light: Daguerreotypes From the Robert Harshorn Shimshak Collection*. San Francisco: Fine Arts Museums, 1986: 9. Cited in Nickel, 136, 140. Emphasis added.

> In conclusion, the DAGUERREOTYPE is not merely an instrument which serves to draw Nature; on the contrary it is a chemical and physical process which gives her the power to reproduce herself.[235]

Daguerre presents his process as one that will endow Nature with new powers; his emphasis is less on the technology he has developed than on what it will allow Nature to do. And in this sense, Daguerre's salesmanship of the daguerreotype conflicts with a recent philosopher's description of the claims made for photography in its earlier years. In *The Engine of Visualization*, Patrick Maynard writes that "the early claims made for any of the processes reviewed here . . . present their technologies as extensions of our powers. In general, that is what we can say all technologies are, extenders or *amplifiers of our powers* to do things."[236] But in this case, and many others, photography was described less as an extension of the human senses than as an extension of the power of nature. This point is crucial to an understanding of the early reception of photography. As noted in the previous chapter, the camera was often presented, in its early years, as a kind of self-negating technology, one that would give Nature, or God, the power of self-representation without adding distortion. It empowered humans by enabling them to view and preserve what had previously been unseen and transitory; but it was seen more as an extension of the divine eye than of the human eye. And because it was an instrument which empowered Nature, the camera itself accrued a portion of the sanctity with which Nature, at the time, was viewed.

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[235] Reprinted in Trachtenberg, *Classic Essays*, 11-13;13.

[236] Patrick Maynard, *The Engine of Visualization: Thinking Through Photography*. Ithaca: Cornell University Press, 1997; 75.

William Henry Fox Talbot utilized similar rhetoric while promoting *The Pencil of Nature* (1844-46), his account of the experiments that led to his invention of the calotype. Talbot advertised his text -- which, with its tipped-in photographs and photograms, was the first photographically illustrated book -- by emphasizing the action of the sun in the creation of images. In an advertisement placed in *The Scotsman* in 1845, Talbot wrote:

> Sun Pictures
>
> The Plates of this Work are all ACTUAL PHOTOGRAPHS, and not (as some have supposed) Engravings in Imitation. They are formed and impressed on the paper by the action of LIGHT alone; and therefore do not require in the operator any knowledge of the Art of Drawing.[237]

Like Daguerre, Talbot elides any mention of human action from his description of the photographic experience, claiming that it is "by the action of LIGHT alone" that the images are formed. The light, rather than the human photographer, authorizes the photo as it uses the camera as its pencil. Despite the fact that one of the main benefits of Talbot's process was that, as a negative-positive process, it allowed for multiple copies of images, Talbot claims that his photographs are not imitative images; each inscription is unique and original. And how could it not be, considering its author?

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[237] "Sun Pictures," *The Scotsman*, 22 February 1845. April 11, 2006. <http://www.edinphoto.org.uk/1_P/1_photographers_talbot_pencil_of_nature.htm>

Carol Armstrong makes a similar point in her discussion of the photograms Talbot included in *The Pencil of Nature*. Talbot created his photograms by laying various objects, including plant leaves and pieces of lace, on top of sensitized paper, which was then exposed to light. Translucent parts of the objects would let light through, marking the paper; opaque objects would block it, leaving the paper dark. The result was a positive image that looked like a negative; Talbot called the this first impression "an original or negative image: that is to say, directly taken from the lace itself."[238] Created without the aid of a camera, a photogram, as Armstrong notes, "stands much closer to its origin than the photograph made with the camera."[239] She writes:

> The photogram is simply the most original of original copies, with no subject, no apparatus standing in for the subject, no space interposed between the original and the copy, and therefore no interruption of the direct contract between them or of the natural continuum between one and the other. The originality of art or of the author hardly enters into the question: it is the originality of Nature that matters.[240]

And yet, as we have seen, even when the camera was present, it was often treated rhetorically as if it were not there. Talbot's photograms may have represented what

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[238] Carol Armstrong, *Scenes in a Library: Reading the Photograph in the Book, 1843-1875*. Cambridge, Mass.: The MIT Press, 1998; 156-7.

[239] Armstrong, 158.

[240] Armstrong, 160.

Armstrong calls the "sine qua non of *The Pencil of Nature*,"[241] but in the popular imagination, at least, the mechanical presence of the camera rarely detracted from the perceived authenticity of the image.

"The Pencil of Nature" is an accurate description of the way in which photography was viewed in America during its first decades, but it was the daguerreotype that incited the enthusiasm of Americans; and so it is to the reception of the daguerreotype that we should return. The inventor Samuel Morse, who conducted very early photographic experiments at Yale while studying chemistry with Benjamin Silliman, admired Daguerre's work, and was one of the first Americans to view it in Paris.[242] Morse echoed Talbot's conception of the camera as "the pencil of nature" when he wrote that daguerreotypes "*cannot be called copies of nature, but portions of nature itself.*"[243] Morse thought that the camera would aid artists in their work, but he suggested that daguerreotypy would enable them to become amateur natural historians as they collected "a superabundance of *materials* and not *copies*."[244] Daguerreotypes, conceived as the raw material of nature, would bring into the home the kind of empirical evidence most privileged in the emergent "culture of proof." John A. Whipple took this one step farther in 1852 as he suggested that the medium of photography could play an active role in the gathering of empirical evidence:

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[241] Armstrong, 160.

[242] Batchen, 39-42.

[243] Quoted in Richard Rudisill, *Mirror Image: The Influence of the Daguerreotype on American Society*. Albuquerque: University of New Mexico Press, 1971: 57.

[244] Rudisill, 57.

> . . . it is in the power of every daguerreotypist to greatly aid the naturalist in his researches, giving him in a few moments drawings of invisible objects penciled by Nature's own hand, which it would be impossible for him to obtain in any other way. . . . [245]

Whipple contended that the camera could capture "invisible objects" in Nature, thereby becoming the ideal tool for the culture of proof. As it provided permanent records of ephemeral phenomena, the camera would make visible new avenues of investigation for the naturalist.

One of the earliest published descriptions of photography in America, "New Discovery in the Fine Arts," appeared in an April 1839 issue of *The New Yorker*. Printed four months before the French Academy des Sciences announced the details of Daguerre's invention to the world, the article heralded the new technology as a "Wonderful wonder of wonders!" and suggested that it would entice engravers to "drink up [their] aquafortis and die!"[246] Although the article is only three paragraphs long, it captures the mix of amazement and speculation that would come to characterize many early discussions of the new medium.

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[245] John A. Whipple, "Microscopic Daguerreotypes," *Photographic Art-Journal*, October 1852. Reprinted in Merry A. Foresta and John Wood, *Secrets of the Dark Chamber: The Art of the American Daguerreotype*. Washington, D.C.: Smithsonian Institution Press, 1995: 262-263; 263.

[246] "New Discovery in the Fine Arts," *The New Yorker*, April 13, 1839. Reprinted in Wood, *Secrets*: 223-225; 224.

The author cites a number of ways in which the camera would change society. Among the most fascinating of them is a description of the effect that the camera would have on American churches:

> You drawers of churches, Britton, Pugin, Mackenzie, beware lest you yourselves be drawn in. Every church will show itself to the world without your help. It will make its wants visible and known on paper; and through [sic] vestry and church-warden quash the church rates, every steeple will lift up its head and demand proper repair.[247]

Even in this early reaction to the photograph, the author perceives that the vision of the camera is omnivorous. Should a painter stand within the frame, he, too, would be gathered in by the undiscriminating eye of the camera. By displaying an objective view of the world, the daguerreotype would work as a tonic against romanticism. No longer would a human artist be able to sentimentalize an old church in order to make a pretty picture; the cold eye of the camera would do away with human artifice, making plainly visible the wants and needs of its subjects. The author, no doubt, chose to write about a church because of its status as a standard subject of romantic pictures. But metaphorically, the passage suggests the ways in which the camera slipped into the space between the public and its religious practices, subtly redefining the relationship between the two.

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[247] Wood, *Secrets*, 224.

The new views provided by the daguerreotype could be both transcendent and startling. In a review of Daguerre's 1839 show in Paris, a writer for *The Knickerbocker* captured the amazement with which Americans viewed the first daguerreotypes:

> We have seen the views taken in Paris by the 'Daguerreotype,' and have no hesitation in avowing, that they are the most remarkable objects of curiosity and admiration, in the arts, that we have beheld. **Their exquisite perfection almost transcends the bounds of sober belief**.[248]

The final sentence captures perfectly a number of elements of the reception of the daguerreotype in America. Daguerreotypes seemed so flawless, so clear, and so detailed that they taxed "the bounds of sober belief." They seemed transcendent, like visions from another realm. The quasi-religious undertones of the author's comment are obvious: to look at a daguerreotype for the first time was to look at the world through a more perfect eye.

When describing daguerreotypes, writers often resorted to religious allegories and metaphors. In 1851, J.H. Fitzgibbon published an article in *Western Journal and Civilian* in which he referred to daguerreotypy as "*Nature copying nature by nature's hand*." Fitzgibbon expanded on this sentiment:

> With what exquisite feelings of pleasure must be the consciousness that the civilized world are now practicing that beautiful art of which he was

[248] "The Daguerreotype," *The Knickerbocker* (December 1839). Reprinted in Wood, *Secrets*: 230-232; 230.

> the happy discoverer, and to know that every time the sun rises the name of *Daguerre* is written:
>
> "With a pencil of light"
>
> on countless myriads of tablets in both hemispheres. And, proud may we be who find the enchanter's wand placed within our own grasp, that we too, can command the sun to stand still, and find him obeying our slightest wish, ministering to our fondest loves, and holiest affections, with an alacrity almost beyond the power of comprehension.[249]

The camera seemed to confer superhuman powers upon its human operators, putting the power of the sun at their command. Fitzgibbon's metaphor recalls the Old Testament scene of God writing the ten commandments on stone tablets. Given the power of divine sight, Americans could turn it towards their "holiest affections" as they created new miracles of the modern age.

Fitzgibbon's mention of "the enchanter's wand" speaks to the associations with witchcraft that attached themselves to the daguerreotype in popular discourse. Daguerreotypes, with their shimmering, mirror-like surfaces and perfect replication of detail, seemed uncanny, and possibly derived from magical incantation. In *The New Yorker*, an anonymous author described photography as "the real black art of true

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[249] J.H. Fitzgibbon, "Daguerreotyping," *Western Journal and Civilian* (1851). Reprinted in Wood, *Secrets*: 240-242; 240-41.

magic."[250] These darker suggestions about the origins of the camera's vision implied another, more alchemistic side to religious interpretations of the daguerreotype. To some, the eye of the camera seemed to give human insight into the mind of God; to others, such privileged vision could only have been made possible by witchcraft.[251] Daguerreotypes were unsettling, offering both the awesome and the terrifying aspects of the sublime. As Americans handled their cameras and regarded their products, they sensed the power that had been put into their hands. It was a responsibility that they took up, generally, with enthusiasm, but one which gave rise to fear and doubt, as well.

Among the most notable expressions of this kind of fear was an article about the daguerreotype that appeared in a German newspaper, *Der Leipziger Anzeiger*, in 1839. After a local optics expert failed to get the daguerreotype camera to work, the author of the article railed against the medium, and denounced the daguerreotype as an attempt by man to overstep his natural boundaries. Daguerreotypes, he claimed, were blasphemous:

> Wanting to hold fast to transitory mirror-pictures is not only an impossibility, as has been shown by basic German research, but even the wish to do so is blasphemy. Man is created in the image of God, and God's image cannot be captured by any man-made machine. . . . The man

[250] Wood, *Secrets*, 224.

[251] Douglas R. Nickel argues that "when Talbot and his contemporaries offer up images of fairies, fortune-tellers, spirits, and alchemy, they do so poetically, as an exercise of wit, or as a way of evoking and containing the very superstitions and defunct belief systems that post-Enlightenment science sought to vanquish." Nickel also contends that tropes of natural magic point to the shared "classical and medieval doctrines out of which modern science arose, namely, alchemy and the hermetic tradition." Nickel, 133. 134.

> who begins such a thing must consider himself even wiser than the Creator of the World.[252]

While attempts to capture an echo of God's image struck this author as the height of presumptive arrogance, he averred that "only the supremely inspired artist may dare -- when he is driven by Heavenly inspiration . . . to try to reproduce man's Godlike features."[253] The author's problem with the daguerreotype was twofold: first, as a machine-derived image, it seemed incapable of inspiration, and was condemned, therefore, to rote duplication. But that duplication turned out to be so realistic and life-like that it posed a danger to morality in ways that seem to prefigure modern anxieties about the cloning of animals. Just as, in the modern era, we worry that the line between the artificial and the authentic has become increasingly blurred, the camera produced simulacra of the world that seemed indistinguishable from the real thing. A daguerreotype did not announce itself as art, like a painting; instead, it seemed to claim for itself the provenance of the real. In the eyes of this German writer, the daguerreotype did not reinforce the power of God, but rather threatened to undermine God's authority by recreating it so realistically.

The author continued his assault on the daguerreotype by drawing a parallel between the photograph and the pool in which Narcissus saw his own reflection. Photographic images, he argued, would entrap humans in their own vanity:

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[252] *Der Leipziger Anzeiger* (1839). Trans. Karl Schleunes. Quoted in Rudisill, 50.

[253] Rudisill, 50.

> God has, to be sure, tolerantly forborne the mirror in His creation as a vain toy of the Devil. Most likely, however, He is regretting this tolerance, especially because many woman are using mirrors to look at themselves in all of their vanity and pride. But no mirror, neither of glass nor of quicksilver, has yet received permission from God to hold fast the image of the human face. God has never allowed the Devil's artistry, indwelling in mirrors, to go to such a high degree that the image of God or the image of man should come into his power.[254]

The sexist undertones of this passage delineate clearly the ways in which the camera unsettled various aspects of power and control in nineteenth-century society. Circumscribing the author's fears about the camera becoming a tool of the Devil was a critique of feminine authority: by giving women access to permanent mirrors of their bodies, he believed, the camera would encourage vanity and pride. The author sought to reassert male control over the female subject by arguing, on moral and religious grounds, that the camera represented a threat to established structures of power.

In this, we see a gender-based corollary to what Jonathan Crary has identified as "an uprooting of vision from the stable and fixed relations incarnated in the camera obscura" between 1810 and 1840.[255] In this case, the photographic camera threatened the fixed lines of power in patriarchal society by giving women the freedom to contemplate their own bodies. In his attempt to reassert control over those bodies, the *Leipziger*

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[254] Rudisill, 50.

[255] Jonathan Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century*. Cambridge, Mass.: MIT Press, 1990: 14.

author exemplifies one response to such an upheaval: a heavy-handed, moralistic attempt to quash the technology that threatened to disturb established gender relations.[256]

In another sense, though, this passage speaks to common anxieties about the daguerreotype. The experimental pre-history of photography was might be summarized as a series of attempts to fix camera images on light-sensitive surfaces. The camera obscura had been around for centuries, but the struggle involved making its images permanent. The *Leipziger* author complains that because the daguerreotyped plate "hold[s] fast the image of the human face" without "permission from God," it is blasphemous. But the author suggested also that the camera would allow its user to capture not only a human face, but also the face of God, in a permanent mirror. The daguerreotype, in his view, perverted religion into idolatry, and allowed humans to worship false images of themselves and of God.

The *Leipziger* author argued that the daguerreotype would cause a "mass epidemic of vanity" that could undermine Christianity itself:

> Now: Should this same God, who for thousands of years has never allowed that mirror-pictures of men should be fadeless, should this same God suddenly become untrue to His eternal principles and allow that a Frenchman from Paris should set loose such a devilish invention into this World!!?? We must make clear, after all, how unChristian and Hellishly

[256] Crary's point is more subtle than the one I am making here -- he argues that some of the "central components of nineteenth-century 'realism,' of mass visual culture, *preceded* the invention of photography and *in no way required* photographic procedures or even the development of mass production techniques. Rather they are inextricably dependent on a new arrangement of knowledge about the body and the constitutive relation of that knowledge to social power." Crary, 17.

> vain mankind would become if everyone could have his own mirror-picture made for filthy money and reproduced by the dozen. There would be a mass epidemic of vanity that mankind would become godlessly superficial and godlessly vain. And if this "Mon-sewer" Daguerre in Paris maintains a hundred times that his human mirror-pictures can be held fast on silver plates, this much a hundred times be called an infamous lie, and it is not worthwhile that German masters of optics concern themselves with this impertinent claim.[257]

For decades, scientists and tinkerers had struggled to fix the camera obscura image on a plate. Now that they had done so, it seemed to some that humankind was destined to fall in love with its own image, and to lose the favor of God in the process. More important than the specific terms the author used, however, was the larger fact that he expressed them in a religious register. Even in the eyes of its most ardent critics, photography belonged in a theological context. From the very beginning, it posed moral and religious quandaries to those who considered it: once they were able to look through the eye of God, would humankind falter before that greater vision?

Many Americans seemed untroubled by the moral dangers of photography outlined by the *Leipziger* author, though those who were disturbed could find their fears exploited in the popular fiction of the day.[258] Those doubts that were expressed, however, were overwhelmed by the popular enthusiasm for the medium. One writer,

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[257] Rudisill, 50.

[258] See Trachtenberg, "Keyword," 30-37.

surfing upon the crest of that tide, went so far in his enthusiasm for photography that he claimed it would offer a kind of cultural Esperanto, a universal language that would foster peace and understanding throughout the world. In an 1840 issue of Cincinnati's *The Daily Journal*, for example, a writer described the daguerreotype as a kind of divinely inspired language:

> Its perfection is unapproachable by human hand, and its truth raises it high above all language, painting, or poetry. It is the first universal language, addressing itself to all who possess vision, and in characters alike understood in the courts of civilization and the hut of the savage. The pictorial language of Mexico, the hieroglyphics of Egypt are now superseded by reality.[259]

Transcending the cultural differences between "the courts of civilization and the hut of the savage," the daguerreotype fulfils the long dreamed-of hope for a universal language. As a pictorial language, its audience need only "possess vision" to grasp it, yet its claim to universal status does not rest purely in its status as a visual object, for the author includes another visual medium, painting, among the arts that the daguerreotype surpasses. Instead, it is the daguerreotype's perfection -- and more specifically, the fact that its perfection is super-human in origin -- that raises it above the sister arts. The author suggests that Mexican pictorial languages and Egyptian hieroglyphics had now been "superseded by reality." Daguerreotypes seemed to have an *original* connection to

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[259] "The Daguerreolite," *The* [Cincinnati] *Daily Chronicle*, vol. 1, no. 38 (January 17, 1840): 2.

the earth and to the heavens -- not like human artifacts dug up from the ruins of past civilizations, but rather like primordial objects that preceded civilization itself. Reminiscent of Whitman's "uniform hieroglyphic," which had been "designedly dropped,"[260] the daguerreotype stood as a transcendent sign upon whose polished surface could be read the mysteries of the universe.

As photographic technology advanced, so, too, did the metaphors used to characterize it. In an 1853 article in the *Photographic Art-Journal*, an anonymous author set out to describe the latest developments in photographic equipment. At the end of his piece, the author quoted "a foreign writer" who rhapsodized over the possibilities presented by the stereoscope -- a device that, by displaying two stereographic photographs taken from slightly different perspectives, gave the illusion of a three-dimensional perspective:

> Aided by the stereoscope, what may we not expect to see realized? . . . . The harmonious elegance of the remains of Greece and examples of Roman art may thus be brought home and made to minister to our pleasures -- instructing and refining our tastes, and teaching all the mysteries of the beautiful, behind which, as under the shelter of a zephyr-woven veil, we may survey all that is good, **and gaze upon the outshadowing of the Divine**.[261]

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[260] Walt Whitman, *Leaves of Grass: The First (1855) Edition*, ed. Malcolm Cowley. New York: Penguin, 1986: 29.

[261] "Photography in the United States," *Photographic Art-Journal*, June 1853. Reprinted in Wood, *Secrets*, 271. Emphasis added.

Photography seemed to offer nothing less than a peek behind the curtain of divine intention. As an epistemological tool, the photograph seemed unsurpassed. It would explain the ways of God to man.

Photography and Science

I have suggested throughout this dissertation that nineteenth-century descriptions the camera fused central aspects of scientific and religious discourse. That was particularly true when the camera was used to capture images at the microscopic level. The rhetoric that theologians used to describe "continuing care" -- the theory, outlined at the beginning of the nineteenth century by William Paley, that God created the world and providentially designed its parts for the benefit of humankind -- often rested on the "attention" that God had paid to smaller creatures and plants of the earth as evidenced by their intricate structures and behaviors. According to this argument, if so much exertion had been spent on the minutiae of the world, then surely God had devoted even more attention to humankind. It was the seventeenth-century discovery of the microscope, of course, that made possible the visualization of miniscule objects. Lorraine Daston has argued that by the late seventeenth century, the microscope provoked new arguments about the nature of the world and universal design. Daston points out that with the invention of the microscope, people came to believe that "the art of God revealed its

finest workmanship only upon closer, internal scrutiny."[262] This opened up a new opposition between "the human art of macroscopic exteriors and the divine art of microscopic interiors." René Descartes believed that the central difference between the "machines" of art and nature was that nature's machines were made of smaller and more ideal springs and wheels.[263] And Robert Hooke, the English father of microscopy, felt that putting man-made objects under a microscope was a fruitless endeavor, for it only revealed them to be "rude, misshapen things;" he contrasted the microscopic view of a metal needle, which looked as rugged as a mountain range, with the works of Nature, whose "deepest Discoveries shew us the greatest Excellencies." This, he found, was "an evident Argument, that he that was the Author of these things, was no other than the Omnipotent."[264]

In 1851, a college President named Lewis W. Green utilized the concept of continuing care in an address he gave to a Presbyterian audience at the University of Virginia:

> [God] hath not disdained to lavish *all* the resources of his infinite wisdom, his boundless benevolence, and Almighty power, in molding the minutest portion of the minutest member of one of those invisible animalculae,

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[262] Lorraine Daston, "Nature by Design," in *Picturing Science, Producing Art*, Caroline A. Jones and Peter Galison, eds. New York: Routledge, 1998: 232-253; 245.

[263] Daston, 245-6. René Descartes, *Principia philosophiae* (1644), in Charles Adam and Paul Tannery, *Oeuvres de Descartes*, 12 vols. (Paris: Léopold Cerf, 1897-1910), IV.cxcvii, vol. 9; 321-22.

[264] Daston 246.

> whose teeming myriads live and revel and die *unseen* . . . and will he not care for you, oh ye of little faith?"[265]

Microscopic science was rapidly expanding, and the camera helped make the "teeming myriads" of micro-organisms -- each one of which reinforced the sense that the universe had been designed by a higher power -- increasingly visible. When they made photographic studies of micro-organisms, both Daguerre and Talbot increased that visibility. Talbot expressed his interest in microscopy in his first major scientific paper, "Experiments on light" (1834). In it, he wrote about the beauty of the universe:

> [The crystals] rapidly moved onwards, appearing by turns luminous and obscure, and resembling in miniature the coruscations of a firefly. It was impossible to view this without admiring the infinite perfection of nature, that such almost imperceptible atoms should be found to have a regular structure capable of acting upon light in the same manner as the largest masses, and that the element of light itself should obey in such trivial particulars the same laws which regulate its course throughout the universe.[266]

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[265] [Lewis W. Green], "Revelation, and Natural Science. Number 1," *Southern Presbyterian Review* 5 (1851): 93-111;95; *The Works of Creation Illustrated*, 259. Cited in Bozeman, 84. An animalcule is a microscopic animal organism.

[266] William Henry Fox Talbot, "Experiments on light." *Phil. Mag.*, November 1834, 321-34. Cited in H.J.P.Arnold, *William Henry Fox Talbot: Pioneer of Photography and Man of Science*. London: Hutchinson Benham, 1977; 74.

The rhetoric Talbot used to describe the beauty of the crystals on a microscopic level was reminiscent of Robert Hooke's disquisition on the perfection of the world two hundred years earlier. Both writers saw, on the microscopic level, an example of the "infinite perfection of nature," though Hooke was more willing than Talbot to name the author of that perfection.

Daguerre used his new invention to make a microscopic study of a spider. In a letter Samuel Morse wrote from Paris, he described the experience of viewing Daguerre's plates for the first time. Morse put Daguerre's plate itself under a microscope, which revealed even more minute detail:

> You perceive how this discovery is, therefore, about to open a new field of research in the depths of microscopic Nature. We are soon to see if the minute has discoverable limits. The naturalist is to have a new kingdom to explore, as much beyond the microscope as the microscope is beyond the naked eye.[267]

The "new kingdom" of the naturalist that Morse described ultimately buttressed Paley's notion of "continuing care." For religious theologians, the marriage of the camera and the microscope was especially suited to reinforce a belief in providential design: the daguerreotype's ability to replicate exactly the most minute aspects of the most complex tableaux was often cited by admirers of the technology. Because the images seemed to have been produced not by human hands, but by "the pencil of nature," daguerreotypes

[267] Quoted in Rudisill, 77.

fulfilled Orville Dewey's wish for "statement, specifications, facts, details, that will illustrate the wonderful perfections of the infinite Creator." Edgar Allan Poe arrived at a similar conclusion when he wrote that "If we examine a work of ordinary art, by means of a powerful microscope, all traces of resemblance to nature will disappear—but the closest scrutiny of the photographic drawing discloses only a more absolute truth, more perfect identity of aspect with the thing represented."[268] The photograph seemed to reveal the perfection of God's universe because it disclosed, at every level, the perfection and order of the world.[269]

Specimens in the Great Picture Gallery of Eternity

Alan Trachtenberg has described the ways in which the mirror-like properties of the daguerreotype produced a doubling effect on the viewer's perception:

> It also resembled a looking glass, another object charged with magical associations. By a slight shift of focus from the image to the surface on which it appears, beholders see their own reflections. A doubling of

[268] Trachtenberg, *Classic Essays*, 38.

[269] Poe, interestingly, sets up a binary in which truth and perfection are aligned with minute detail, while abstraction becomes aligned, if not quite with falsehood, then with the fallibility of the human hand. This in itself shows the degree to which photography altered popular conceptions of artistic truth and perfection: whereas, in earlier periods, the perfection of a work of art was measured by the artist's ability to create images that looked realistic when viewed from a distance of several feet, the microscopic vision of nineteenth-century science gave birth to a new aesthetic standard which demanded realism from a distance of a few inches.

> image upon image: the viewer's image, mobile and immediate, superimposes itself upon the fixed daguerrean image. The effect was apparitional in another sense as well: at the merest tilt of the plate, the photographic image flickers away, fades into a shadowed negative of itself while still entangled in the living image of the beholder. The primary image becomes evanescent, suspended in a depthless medium.[270]

Just as two contrasting images shimmered on the daguerrean plate, the competing discourses of science and religion intermingled in the words that nineteenth-century Americans wrote about photography. Upon those linguistic surfaces, important debates over scientific proof and religious belief would play out.

As Lyell and Darwin contradicted biblical parables of the earth's creation and threw religious cosmologies into doubt, both scientists and theologians strove to find a place for religion in a rapidly changing world. As a technology that exemplified the new spirit of scientific innovation, but that was interpreted, from its earliest days, within a framework of religious belief, photography was suited to heal the growing breach between religion and science. It should come as no surprise, then, that two books devoted to new theories of the universe based on recent scientific discoveries positioned photography as the basis for new models of the innermost workings of the cosmos.

Both Edward Hitchcock's *The Religion of Geology* (1852) and Balfour Stewart and P.G. Tait's *The Unseen Universe* (1875) presented startling theories of the nature of the universe and marshaled scientific evidence in support of their claims. Each book

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[270] Trachtenberg, *RAP*, 13.

found, in photography, a suggestive model for a diverse set of phenomena, such as the interaction of atoms, the relationship between God and humankind, and the nature of visible and invisible elements of the world. In both works, photography functioned as a proof, and as a tantalizing conundrum: if sensitized metal plates could capture rays of light and transmogrify them into intricately detailed images of the world, what other invisible elements were floating around, waiting to be discovered?

Balfour Stewart and P.G. Tait published *The Unseen Universe: or, Physical Speculations on a Future State* in 1875, long after the daguerreotype era in America had ended. Yet *The Unseen Universe* shows that even after daguerreotypes had faded from American photographic practice, the initial reception continued to inform popular beliefs about the medium: photography never quite lost the spiritual aura with which it entered the American popular consciousness. Stewart and Balfour's explicit goal in *The Unseen Universe* was to bring scientific and religious discourses into a dialogue, in order to "show that the presumed incompatibility of Science and Religion does not exist."[271] The authors quoted widely from cutting-edge work in physics, chemistry, and astronomy, and juxtaposed the research of Darwin, Herschel, and Helmholtz with passages of biblical scripture.

The central tenet of *The Unseen Universe* is that the visible sphere developed out of the "unseen" universe, and that all matter is infused with an energy-transmitting, but invisible, ether. While much of the book deals with phenomena in the visible world, a

[271] Balfour Stewart and P.G. Tait, *The Unseen Universe: or Physical Speculations on a Future State*. New York, MacMillian and Co, 1875; iii.

chapter titled “The Unseen Universe” uses photography in a crucial passage. Balfour and Stewart had noted that the universe experiences a continual dissipation of energy. As they tried to account for this lost energy, the authors turned to photography for an answer:

> We have seen that this medium -- this ether -- has the power of transmitting motion from one part of the universe to another. A picture of the sun may be said to be traveling through space with an inconceivable velocity, and, in fact, continual photographs of all occurrences are thus produced and retained. A large portion of the energy of the universe may thus be said to be invested in such pictures. (156)

Balfour and Stewart posit the universe as a kind of mammoth camera, and suggest that much of the energy in the universe is taken up by the practice of picture-taking. By conceiving of ether as an all-pervading, photo-sensitive substance, the authors imagine a cosmos that is built upon the idea of photography.

In a later passage, Balfour and Stewart suggest that, in addition to being a photographic substance, ether plays an important role in mediating between the visible and invisible spheres:

> May we not regard ether or the medium as not merely a bridge between one portion of the visible universe and another, but also as a bridge between one order of things and another, forming as it were a species of

> cement, in virtue of which the various orders of the universe are welded together and made one? (158)

The photographic ether that filled the universe served as the "concrete" that connected the seen and unseen universes to one another. Photography, in this formulation, not only revealed the secrets of the universe, but also held it together.

Stewart and Tait's conception of a photographically sensitive ether echoed the earlier ideas of Edward Hitchcock who, in *The Religion of Geology*, proposed a similar cosmology based on the principles and discoveries of modern science.[272] In 1851, Hitchcock stood on the front lines of what he described as a "holy war" between religion and science.[273] Hitchcock was a respected geologist and Congregationalist minister who had begun teaching science at Amherst College in 1825 before assuming the college presidency in 1845; six years later, he published *The Religion of Geology and Its Connected Sciences*, which gathered together a series of lectures he had delivered to his college geology classes throughout the previous decade. In his book, Hitchcock sought to "exhibit all the religious bearings of geology" (vi) and to convince his readers that no other branch of science "is so prolific of direct testimony to the benevolence of the Deity" (26). Hitchcock was concerned that preachers entered the culture wars of the day without proper ammunition. If his fellow ministers could familiarize themselves with the work of "the enemy" -- scientists who used fossil evidence to argue against the religious

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[272] See Chapters 2 and 3 of this dissertation for additional discussion of Hitchcock.

[273] Edward Hitchcock, *The Religion of Geography*. Boston: Phillips, Sampson, and Company, 1852; xii. Further citations will be noted in the text.

belief in the unitary origin of the human race -- they might "be able not only to silence his guns, but, as every able defender of the truth ought to do, to turn them against its foes" (xi). Hitchcock proposed that theological seminaries train young ministers in the "religious bearings" of the natural sciences so that they might "go forth to their work" with "the ability to vindicate the cause of religion against the assaults of the skeptical naturalist" (xii).

As he argued that recent geological discoveries supported the biblical account of creation, Hitchcock turned, at a crucial point, to the subject of photography. In a remarkable chapter titled "The Telegraphic System of the Universe," he suggested that new technologies such as the daguerreotype and the telegraph revealed the secrets of the cosmos. The central metaphor of that chapter combined a biblical scene with one of the dominant early metaphors of photography -- that of the impartial witness.

Hitchcock begins the chapter by observing that "in order to impress some important truth or transaction, men have sometimes represented surrounding inanimate objects as looking on and witnessing the scene, or listening to the words, and ready ever afterwards to open their mouth to testify to the facts, should man deny them" (409). His first example of an inanimate object used to record a scene is the biblical covenant between Jehovah and the Israelites, in the time of Joshua. Hitchcock writes:

> To fix the transaction as firmly as possible in the minds of the fickle people, he *took a great stone and set it up there under an oak that was by the sanctuary of the Lord. And Joshua said unto all the people, Behold, this stone shall be a witness unto us. For it hath heard all the words of the*

> *Lord which he spoke unto us. It shall, therefore, be a witness unto you, lest ye deny your God*. (409)

The passage quoted by Hitchcock appears at the end of the Book of Joshua, which deals with the fate of the Israelites after the death of Moses. This Book begins and ends with images of stones set in memory of God's word: the passage above appears at the end of the Book, while at the beginning of the Book, God instructs Joshua to call one man from each tribe of Israel to set a stone among them:

> 6 That this may be a sign among you, *that* when your children ask *their fathers* in time to come, saying, What *mean* ye by these stones?
> 7 Then ye shall answer them, That the waters of Jordan were cut off before the ark of the covenant of the LORD; when it passed over Jordan, the waters of Jordan were cut off: and these stones shall be for a memorial unto the children of Israel for ever.
> 8 And the children of Israel did so as Joshua commanded, and took up twelve stones out of the midst of Jordan […]
> 9 And Joshua set up twelve stones in the midst of Jordan, in the place where the feet of the priests which bare the ark of the covenant stood: and they are there unto this day.[274]

[274] *The Holy Bible*, King James Version. New York: Penguin Group, 1974; 197.

In both passages, the stones, which stand in testament to God's word, act not just as a registers of God's power, but as visual reminders of that power. More importantly, the stones are permanent records that do not fade with time ("and they are there unto this day"). Etched with traces of holy power, they remind the children of Israel that their lives are bound by a covenant with God.

Hitchcock's use of the word "fix" in this context is surely significant, because it draws an explicit parallel between biblical stones and photographs. As noted earlier, the central problem that occupied photographic experimenters before 1839 involved an effort to **fix** an image on a light-sensitive surface. This achievement was what the newspaper *Gazette de France* emphasized in its 1839 announcement of Daguerre's success:

> M. Daguerre has found the way to fix the images which paint themselves within a camera obscura, so that these images are no longer transient reflections of objects, but their fixed and everlasting impress which, like a painting or engraving, can be taken away from the presence of the objects.[275]

The parallel to the stones in the Book of Joshua is readily apparent: like the stones which "shall be for a memorial unto the children of Israel for ever" and which "are there unto this day," the images produced by Daguerre have a "fixed and everlasting impress." The lexical link that Hitchcock uses to bind this metaphor is the word "fix": in the biblical tale, God inscribes the stones in order to "fix the transaction as firmly as possible in the

[275] Beaumont Newhall, *The History of Photography*. New York: Museum of Modern Art, 1982: 18-19.

minds of the fickle people." Likewise, in an age characterized by technological innovations such as steam power, which sped up travel and mechanical production, the inventors of photography sought to fix images from the fleeting world before they could be forgotten.

Hitchcock begins to tease out his cosmology by continuing to draw upon the parallel of the witnessing stones:

> The discoveries of modern science, however, show us that there is a literal sense in which the material creation receives an impression from all our words and actions that can never be effaced; and that nature, through all time, is ever ready to bear testimony of what we have said and done. Men fancy that the wave of oblivion passes over the greater part of their actions. But physical science shows us that those actions have been transfused into the very texture of the universe, so that no waters can wash them out, and no erosions, communication, or metamorphoses, can obliterate them. (410)

The parallel to the stones in the Book of Joshua has now been turned inside-out: instead of stones bearing witness of God's power to man, Hitchcock contends that nature bears witness of man's actions to God. Like the stones, however, these records are permanent and inerasable. Hitchcock suggests in this passage, and more clearly confirms in the next paragraph, that the evidence of this celestial record-keeping is provided by "the

discoveries of modern science." In a key section, he explicitly refers to the kind of discoveries he has in mind:

> The principle which I advance in its naked form is this: *Our words, our actions, and even our thoughts make an indelible impression on the universe*. Thrown into a poetic form, this principle converts creation
>
> Into a vast sounding gallery;
> Into a vast picture gallery;
> And into a universal telegraph. (410)

In imagining the universe as a "vast picture gallery" or a "universal telegraph," Hitchcock conceives of the daguerreotype as a truly transcendent impression, one that shows the ways of man to God. Through technologies such as the telegraph and the daguerreotype, images of human life would reverberate into the heavens.

Hitchcock argued that "our words, our actions, and even our thoughts, make an indelible impression on the universe" (410). His proofs for this thesis relied on "an appeal to well-established principles of science," such as "reaction" -- the "mutual or reciprocal action of different things upon one another" (411). His first example is a mechanical reaction:

> …every impression which man makes by his words, or his movements, upon the air, the waters, or the solid earth, will produce a series of changes

> in each of those elements which will never end. The word which is now going out of my mouth causes pulsations or waves in the air, and these, though invisible to human eyes, expand in every direction until they have passed around the whole globe, and produced a change in the whole atmosphere; nor will a single circumgyration complete the effect; but the sentence which I am now uttering shall alter the whole atmosphere through all future time. (411)

In Hitchcock's vision of the universe, each human breath and word changes the very fabric of the universe -- an argument which lent additional weight to the traditional theological argument that all human actions have serious moral consequences. Hitchcock proposes that every event in the present indelibly changed the future:

> …not a footprint of man or beast is marked upon its surface, that does not permanently change the whole globe. Every one of its countless atoms will retain and exhibit an infinitesimal, but a real, effect through all coming time. It is too minute, indeed, for the cognizance of the human senses. But in a higher sphere there may be inlets of perception acute enough to trace it through all its bearings, and thus render every atom of the globe a living witness to the actions of every living being. (413)

Hitchcock presents a startling re-conceptualization of the stone from the Book of Joshua with which he began his chapter. From the idea of a stone that bears witness to the

covenant between God and the Israelites, he has moved to a universal model in which "every atom of the globe [is] a living witness" to the actions around it. Each atom of the universe, then, is a stone in miniature; or, better yet, each atom is an eternally receptive daguerreotype, receiving impressions from the world around it and recording those impressions for posterity. This is an analogy that Hitchcock does indeed flesh out later in his chapter.

Before he reaches that point, Hitchcock turns to the subject of optical reactions -- the effects of light upon the surfaces it hits. He cites "the unknown author of a little work entitled "The Stars and the Earth" to draw out a cosmology based upon photography:

> …the universe encloses the *pictures* of the past, like an indestructible and incorruptible record, containing the purest and the clearest truth; and as sound propagates itself in the air, wave after wave, or, to take a still clearer example, as thunder and lightning are in reality simultaneous, but in the storm the distant thunder follows at the interval of minutes [seconds?] *[sic]* after the flash, so, in like manner, according to our ideas, the pictures of every occurrence propagate themselves into the distant ether, upon the wings of the ray of light; and although they become weaker and smaller, yet, in immeasurable distance, they still have color and form; and as every thing possessing color and form is visible, so must these pictures also be said to be visible, however impossible it may be for the human eye to perceive it with the hitherto discovered optical instruments. (418)

Hitchcock describes the entire universe as a camera, as if each particle of light were itself a daguerreotype image hurtling out into the farthest reaches of the universe to bring to distant planets the pictures of human actions on earth. Hitchcock notes that the supreme "optical instruments" are the eyes of God, "for who will doubt that his eye can take in at a glance that universe which he has made" (418). Hitchcock thus casts God as the ultimate picture-taker and the ultimate picture-reader, one who has "powers of vision acute enough to take in all these pictures of our world's history, as they make the circuit of the numberless suns and planets that lie embosomed in boundless space" (418). All human history, Hitchcock suggests, is thrown about the universe in the form of a never-ending series of photographs.[276]

Reaching the apex of his speculative argument, Hitchcock presents a fully articulated vision of a universe based on the principle of photography:

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[276] I am indebted to Geoffrey Batchen for pointing out to me that Hitchcock's theory was an adaptation of Charles Babbage's *Ninth Bridgewater Treatise* (1837). In a section titled "On the Permanent Impression of Our Words and Actions on the Globe We Inhabit," Babbage had argued that the words spoken by humankind made indelible impressions upon the universe. Charles Babbage. *The Ninth Bridgewater Treatise*, 2nd Edition. London, 1838; 112. In the April 13, 1839 *New Yorker* article ("New Discovery in the Fine Arts") discussed earlier in this chapter, the author had speculated that photography presented an opportunity to extend Babbage's theory. ". . . for aught we know to the contrary," he wrote, "other worlds of the system may be peopled and conducted with the images of persons and transactions thrown off from this and from each other; the whole universal nature being nothing more than phonetic and photogenic structures." Wood, 225. Batchen has written extensively about the connections between Babbage and Talbot -- the two were friends, and Babbage exhibited some of Talbot's photographs near his "Difference Engine." See, for example, Geoffrey Batchen, "A Philosophical Window," *History of Photography*, Vol. 26, No. 2 (Summer 2002): 100-112; Geoffrey Batchen, "Electricity Made Visible," in *New Media, Old Media: A History and Theory Reader*, ed. Wendy Hui Kyong Chun and Thomas Kennan. New York: Routledge, 2006: 27-44; and Geoffrey Batchen, *Each Wild Idea: Writing, Photography, History*. Cambridge, Mass.: MIT Press, 2001.

> It seems, then, that this photographic influence pervades all nature; nor can we say where it stops. We do not know but it may imprint upon the world around us our features . . . and thus fill nature with daguerreotype impressions of all our actions that are performed in daylight. It may be, too, that there are tests by which nature, more skilfully than any human photographist, can bring out and fix those portraits, so that acuter senses than ours shall see them, as on a great canvas, spread over the material universe. Perhaps, too, they may never fade from that canvas, but become specimens in the great picture gallery of eternity. (426)

This vision of a universe in which photosensitive ether takes daguerreotype impressions of human events, sends them to the heavens, and arrays them "in the great picture gallery of eternity," reveals the powerful impact of photography on the imaginations of nineteenth-century Americans. If William Henry Fox Talbot thought of his calotype camera as "The Pencil of Nature," an instrument that would allow Nature to draw herself, Hitchcock here imagines Nature *as* the pencil. Daguerreotypes, in Hitchcock's formulation, become detached from the very materials -- the silver-coated copper plate, the iodized vapors, the mercury bath -- that defined them as material objects. Loosened from physical constraints, daguerreotypy as process supersedes the daguerreotype as product. The daylight itself becomes both camera and daguerreotype, both the picture-making apparatus and the picture itself. The universe assumes the properties of the sensitized photographic plate, taking constant impressions of human faces and actions.

The images it captures, as imagined by Hitchcock, are the perfect synthesis of science and religion: they convert human faces into scientific "specimens," laid out for the perusal of an objective eye; but they are marked with a divine imprimatur, and reside in an eternal plane invisible to the human eye, beyond the comprehension of the human mind.

While Hitchcock's rapturous vision was hypothetical -- he prefaced his musings with the conditional phrases, "we do not know but" and "it may be"-- his mélange of religious enthusiasm and scientific hypothesis cannot be dismissed as the creation of an isolated fanatic. Hitchcock was a deeply respected geologist who had published widely in scientific journals, and he was far from being the only person who viewed photography as a medium that could mediate pre-Darwinian conflicts between scientists and religious leaders. His turn to the daguerreotype in the middle of a book on one of the most important intellectual battles of the nineteenth century -- the debate over the implications of the fossil record for the biblical account of creation -- reflects the ways in which photography mediated the divide between scientific practice and religious belief.

It was in this way that the camera functioned as the final proof of God's existence in a rapidly changing culture. Rather than representing reality, cameras seemed to produce it without human intervention, to present more accurate versions of the world than the human eye was capable of producing. As they wrote about this new kind of vision, many Americans did so within the intellectual framework of "the culture of proof." Photography, which fused elements of religious and scientific discourse, became the modern standard-bearer of objective truth. In the passage quoted at the beginning of this chapter, H. J. Morton summed up this idea when he contended that "'truth,' so far as

the representation of spiritual things was concerned, might be found in the word of God! In regard to material things, in Photography."[277] Edward Hitchcock would have agreed -- though he might have added that the spiritual word of God and the material truth of photography would be fused, ultimately, in "the great picture gallery of eternity."

[277] Morton, 180.

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