ANESTHESIA AND ENTERTAINMENT:

NITROUS OXIDE IN NINETEENTH CENTURY AMERICA

by

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A thesis submitted in conformity with the requirements

for the degree of Doctor of Philosophy

Graduate Department of the

Institute for the History and Philosophy of Science and Technology

University of Toronto

Your file Votre référence
ISBN: 978-0-494-39973-6
Our file Notre référence
ISBN: 978-0-494-39973-6

Anesthesia and Entertainment: Nitrous Oxide in Nineteenth Century America. Doctor of Philosophy, 2006, Jenene Wiedemer, Institute for the History and Philosophy of Science and Technology, University of Toronto

Abstract

This thesis combines approaches from the history of science and medicine with the history of popular culture to explain how nitrous oxide was used and understood during the Nineteenth-Century, and how the contexts in which it was used contributed to the adoption of nitrous oxide as an anesthetic. I contend that to understand how this substance was understood medically, we need to uncover its greater cultural significance. Concentrating on events in America, this thesis discusses how nitrous oxide fell out favor as an object of medical inquiry early in the Nineteenth-Century, how Horace Wells' 1845 nitrous oxide demonstration was bound to fail, and how nitrous oxide came to be adopted as a surgical anesthetic in the 1860s. All of these questions are answered by teasing out the larger cultural role played by the gas as an object of popular entertainment.

The key to understanding the multiple functions that this gas played in the nineteenth century can be found by examining both what medical professionals believed about the gas and how these beliefs related to the larger cultural milieu. Nitrous oxide inhalation was large scale entertainment, attracting audiences of up to 3000 people. These exhibitions became more and more popular as their middle class audiences interpreted the gas as a way to distinguish the moral individual from one with a blackened inner character, a continuing social problem throughout the Nineteenth-Century. Horace Wells failed to convince the

medical elite that the gas quelled pain because, unlike Morton with ether, he was unable to disassociate nitrous oxide from its reputation as a substance associated with mass entertainment. Nitrous oxide was finally adopted as an anesthetic in dentistry during the 1860s when G. Q. Colton, the showman, was able to separate nitrous oxide from "laughing gas". Colton changed the locations, technology and terminology surrounding nitrous oxide, and consequently introduced it into medical culture as an anesthetic, while keeping laughing gas in the realm of entertainment. This thesis is an example of the importance of interdisciplinary historical work and a call for further examination into the cultural significance of a substance that has until now been understood primarily in the context of the history of anesthesia.

Acknowledgements

I would like to thank the Institute for the History and Philosophy of Science and Technology at the University of Toronto for the opportunity to undertake and complete this project. The simple and clear advise of my supervisor, Brian Baigrie, was essential for the completion of my thesis. My other committee members, Pauline Mazumdar and Elspeth Brown, helped me to balance and contextualize the work on nitrous oxide, appealing to sources in the history of medicine and American cultural history that I might have overlooked on my own. The advice of Trevor Levere was essential in formulating my understanding of the early chemical work on nitrous oxide and its cultural ramifications. Thanks to Bert Hall and Paul Thompson for their unwavering support in my final academic year. Fellow graduate students Darrin Durant and Victor Boantza read early chapters and their comments were most helpful. Thanks also to Shana Worthen for her intellectual and emotional support throughout my graduate years and to Jessie Marion for her encouragement, understanding and friendship during the final stages of the writing process.

Librarians and archivists have been of assistance in steering me in interesting research directions and helping me to find sources of information relevant to this thesis. Thanks to Russell Johnson at the UCLA John C. Liebeskind History of Pain Collection, Dr. Scott Swank at the Samuel D. Harris National Museum of Dentistry, Valerie-Ann Lutz at the American Philosophical Society, and Linda Lohr at the Robert L. Brown History of Medicine Collection at SUNY Buffalo. Thanks also to the librarians and staff at the Thomas Fisher Rare Book Library at the University of Toronto for their helpful suggestions on

finding electronic sources, and many thanks to the Inter-Library Loan Department at Gerstein Science Information Centre Library at the University of Toronto for going out of their way to get some very difficult to find items. Thanks to Teller for the opportunity to look through his private collection of magic books and ephemera in Las Vegas. Thanks most of all to A.J. Wright, of the Department of Anesthesiology Library at the University of Alabama at Birmingham for so generously providing copies of some rare nineteenth century material on nitrous oxide from his personal collection.

Lastly, I'd like to thank two dear friends. Without their support, there is no way I would have been able to complete this project. Thanks to Jennifer Keelan, for reading chapters, brainstorming, too many phone calls, and believing in me. Thanks to Penn Jillette for short pointy sentences, kind complements, and the unwavering friendship of a professional liar. Thank you Jenn and Penn; I couldn't have done it without you.

Table of Contents

Table of Figures

List of appendices

Chapter 1. Introduction and Literature review

Introduction

At Massachusetts General Hospital in January 1845, Horace Wells performed the first public demonstration of nitrous oxide anesthesia before a class of medical students.[1] Wells extracted a tooth from a student volunteer. While under the influence of the gas, the student cried out as the tooth was removed. The medical students jeered Wells and refused to listen to the testimony of the student volunteer who, upon recovering from his stupor, declared that he had felt no pain. The demonstration was deemed by those present to be a complete failure. Nearly two years later, at the same location, William Morton demonstrated the use of Letheon, a compound based on sulphuric ether, to quell surgical pain. Morton administered Letheon while a prominent Boston surgeon removed a facial tumor from the patient in front of an audience of physicians and medical

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[1] The date of this demonstration cannot be confirmed. No records of the date are found at Massachusetts General Hospital, and witnesses place the timing as early as fall of 1844. However most primary sources indicate that the event was sometime in late January of 1845. See Gardner Quincy Colton, *Anaesthesia. Who Made and Developed This Great Discovery? A Statement Delivered Upon the Mellowing of Occasion* (New York: A. G. Sherwood & Co., 1886), William J. Morton and William T. G. Morton, *The Invention of Anaesthetic Inhalation; or, "Discovery of Anaesthesia."* (New York: D. Appleton and Company, 1880), Horace Wells, *A History of the Discovery of the Application of Nitrous Oxide Gas, Ether, and Other Vapors, to Surgical Operations* (Hartford: J. Gaylord Wells, 1847).

students in the surgical dome. The patient cried out during the procedure, but remained in a stupor. This demonstration was deemed by those present to be a complete success.

A multitude of historians have examined the development of inhalation anesthesia in depth, and have discussed the details surrounding both Wells' and Morton's hospital demonstrations. Their explanations for Wells' failure and Morton's success vary, exploring both the social and technical differences between these two events. For example, Stephanie Browner and Julie M. Fenster have attempted to explain Morton's success by appealing primarily to the influence of local social networks such as Morton's lengthy association with surgeon Henry Jacob Bigelow. Similar social factors do not explain Wells' failure. Alternately, Norman A. Bergman and Richard Wolfe, in their explanations of Wells failure, focus on the possible technical problems with the demonstration. However, while these personal relationships and technical problems may have contributed to Wells failure and Morton's consequent success, they may not necessarily have caused it.

This thesis explains why Wells' 1844 nitrous oxide demonstration failed by examining in detail that which prior intellectuals have chosen to ignore: the history and development of nitrous oxide gas itself. In this thesis, I integrate the social and material explanations that other historians have artificially segregated to arrive at a novel set of explanations concerning these two demonstrations. While accepting the merit and overall findings of these historians concerning the social and technical elements of the two pain-free surgery demonstrations, I additionally examine in detail how nitrous oxide was used and understood in North America throughout the Nineteenth-Century. Nitrous

oxide turns out to have a unique and important history of its own, aside from its applications in medicine . The wide-spread use of nitrous oxide and its cultural significance are here made explicit, and then incorporated into explaining why Wells' demonstration was doomed to failure. My research shows that Wells failed because nitrous oxide, understood as historically situated in Nineteenth-Century American culture, was in many ways associated with contexts at odds with medical use. My hope is that this thesis will be understood as a template and a call for additional research uniting cultural studies with the detailed historical examination of the production of scientific and medical knowledge.

Literature review

This literature review is designed to accomplish several tasks. First of all, a review of the literature addressing the development of inhalation surgical anesthesia reveals that although the questions addressed in this thesis have been tackled before, they have not been satisfactorily answered. Second, this review outlines possible avenues of discourse concerning the greater cultural understanding of nitrous oxide available to the historian of science and medicine. Third, a review of the contemporary philosophical and sociological literature reveals that contemporary academic methodological developments are indeed relevant and helpful in expanding the application and breath of historical research.

I divide the accumulated research, for reasons of manageability, into four general areas that collectively can be understood as applicable to the history of the substance nitrous oxide and its related material, social and philosophical comprehension. The first

section discusses primary sources of various kinds, including published texts and newspaper clippings, many of which have not yet been examined by historians of science and medicine. The second section addresses the secondary historical work of scientists and physicians, which makes up the majority of the published literature specifically about nitrous oxide and the inhalation anesthesia demonstrations in the 1840s. The third section deals with professional historians and covers topics about social and cultural history related to the history of anesthesia, medicine, and the cultural milieu of the Nineteenth-Century. The final section deals with sociological and philosophical theories that are pertinent to this project, and reviews how these ideas relate to the history of nitrous oxide and anesthesia.

Contemporary Accounts and Primary Sources

In order to understand how nitrous oxide came to be used in Nineteenth-Century America, it is necessary to trace the gas back to its earliest uses in Britain. Late Eighteenth-Century works on chemistry outline the earliest isolations of nitrous oxide and discuss methods of procurement. The first of such texts, Joseph Priestley's 1775 *Experiments and Observations on Different Kinds of Air*, reveals how he came to isolate the gas, and gives explicit instructions on how the reader might replicate Priestley's experiments.[2] Priestley moved to the United States in the 1790s, and discussions of

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[2] Even though Steven Hales had discussed the substance that Priestley came to isolate as nitrous oxide in *Vegetable Staticks* (Stephen Hales, *Vegetable Staticks: Or, an Account of Some Statical*

nitrous oxide followed him.[3] American physician Samuel Latham Mitchill, publisher of the first American medical journal *Medical Repository*, created and promoted the doctrine of Septon, a thesis that nitrous oxide was a toxin and the source of various diseases.[4] This idea promoting the toxicity of nitrous oxide served to discourage experimentation with the gas during the 1790s.

In Britain, Thomas Beddoes was inclined to believe that nitrous oxide could be used in medical practice.[5] His interest in factitious or artificially created airs culminated

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Experiments on the Sap in Vegetables: Being an Essay Towards a Natural History of Vegetation. Also, a Specimen of an Attempt to Analyse the Air, by a Great Variety of Chymio-Statical Experiments. (London: W. & J. Innys and T Woodward, 1727).) Priestley's work is an ideal starting point for nitrous oxide history research since he was the first to distinguish the gas as a different substance than nitrous gas. Cf. Joseph Priestley, "An Account of Further Discoveries in Air," *Philosophical Transactions of the Royal Society* 65 (1775): 384-394, Joseph Priestley, *Experiments and Observations on Different Kinds of Air*, Second ed. (London: J. Johnson, 1775), Joseph Priestley, "Observations on Different Kinds of Air," *Philosophical Transactions of the Royal Society* 62 (1772): 147-264.

[3] Cf. Joseph Priestley, "Singular Effects of Gaseous Oxyd of Septon (Dephlogisticated Nitrous Air)." *Medical Repository* 3 (1800): 305. Although Priestley refused any professional affiliations with the American schools, he published prolifically in *Medical Repository*, primarily using the journal to defend his pet phlogiston theory.

[4] Cf. Samuel Latham Mitchill, "The Doctrine of Septon; Attempted after the Manner of Dr. Darwin.," *Medical Repository* 1 (1797): 189-193, Samuel Latham Mitchill, *Remarks on the Gaseous Oxyde of Azote, or of Nitrogene and on the Effects It Produces When Generated in the Stomach, Inhaled into the Lungs, and Applied to the Skin: Being an Attempt to Ascertain the True Nature of Contagion , and to Explain Thereupon the Phenomena of Fever.* (New York: T & J Swords, 1795).

[5] Cf. Thomas Beddoes, *Notice of Some Observations Made at the Medical Pneumatic Institution.* (Bristol: printed by Biggs and Cottle for T.N. Longman and O. Rees London, 1799),

in the establishment of the Pneumatic Institution in Bristol during the 1790s. Beddoes believed that factitious airs could be beneficial in the treatment of disease, and he employed the eager young chemist Humphry Davy to work on the production and potential uses of these new gases. When Davy read Mitchill's ideas connecting nitrous oxide and disease, he became determined to disprove the doctrine of Septon. The result was Davy's *Researches, Chemical and Philosophical, Chiefly Concerning Nitrous Oxide, or Dephlogisticated Nitrous Air, and Its Respiration.*, a considerable effort at over 400 pages, published in 1800.[6] Debates over the legitimacy of Beddoes' medical ideas and Davy's psychotropic experiments with the gas and lectures on nitrous oxide at London's Royal Institution in 1801 all resulted in the gas gaining an eclectic reputation. Satirical articles and political cartoons published in the first years of the Nineteenth-Century linked nitrous oxide use to the French Revolution and accompanying "enthusiasms".[7] In the United States, the publication of the first doctoral dissertation on nitrous oxide emphasized the subjective effects of the gas first described in Davy's work, distancing the

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Thomas Beddoes, *Outline for a Plan for Determining the Medicinal Powers of Factitious Airs* (1795), Thomas Beddoes and James Watt, *Considerations on the Medicinal Powers and the Production of Factitious Airs. Five Parts in One Volume.* (Bristol: Bulgin & Rosser, 1794-1796).

[6] Humphry Davy, *Researches, Chemical and Philosophical, Chiefly Concerning Nitrous Oxide, or Dephlogisticated Nitrous Air, and Its Respiration.* (London: J. Johnston, 1800).

[7] R. Polwhele, "The Pneumatic Revellers: An Eclogue.," *The Anti-Jacobin Review and Magazine* 6 (1800): 424-428, Thomas Wright and R. H. Evans, eds., *Historical & Descriptive Account of the Caricatures of James Gillray; Comprising a Political and Humorous History of the Latter Part of the Reign of George the Third* (London: H.G. Bohn, 1851).

gas from objective study. By the first decade of the Nineteenth-Century, nitrous oxide research in the United States waned.

It was in popular American culture that nitrous oxide thrived. While medical and chemical inquiry into nitrous oxide declined during the first half of the Nineteenth-Century, the use of nitrous oxide gained popularity as a form of entertainment. Accounts of nitrous oxide in popular culture either link it to political ideas, much like the case in Britain, or consist of advertisements for nitrous oxide entertainments. In the United States, an anonymous pamphlet published in 1814 compared nitrous oxide intoxication at a public exhibition with impulsive American military attacks at the Canadian border.[8] Newspaper reports of nitrous oxide entertainments, advertisements for chemical lectures, and references to nitrous oxide in popular periodicals help us to reconstruct what nitrous oxide meant to those living in the United States throughout the Nineteenth-Century.[9]

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[8] *A Cursory Glimpse of the State of the Nation, on the Twenty-Second of February, 1814, Being the Eighty-First Anniversary of the Birth of Washington; or a Physico-Politico-Theologico, Lucubration Upon the Wonderful Properties of Nitrous Oxide, or the Newly Discovered Exhilarating Gas, in Its Effects Upon the Human Mind, and Body; as They Were Exhibited, by Actual Experiment; on the Evening of the Twenty-Third Instant.* (Philadelphia: Moses Thomas, 1814).

[9] Cf. "Domestic," *American* 5, no. 1 (1822): 194-196, "Dramatic Mania," *The New-York Mirror Weekly*, Feb. 16 1828, 255, "Laughing Gas.," *Broadway Journal* June 28, 1845, 403, "Literary and Scientifick Notices," *The Cincinnati Literary Gazette*, Feb. 14, 1824, 55, "Mr. Griscom's Lectures on Chemistry," *Medical Repository* II, no. 3 (1808): 320-324, "Museum," *Microscope* October 26, 1833, An Observer, "Nitrous Oxide," *Ladies Port Folio* 1, no. 7 (1820): 54, Anti-Dram, "Cheap Drunkenness," *American Mechanics Magazine* 1, no. 7 (1825): 107-109, Thomas Green Fessenden, *The Modern Philosopher; or Terrible Tractorations!! In Four Cantos; Most Respectfully*

After 1846, when ether was adopted as the first widely used surgical anesthetic, primary sources fall into roughly three categories: medical accounts of nitrous oxide use in surgery, arguments as to who was the "discoverer" of anesthesia, and more advertisements for public laughing gas entertainments. The first type of account was written as a report published in newspapers and medical journals by medical practitioners for the purpose of reporting the events of a completely new practice: anesthetization. These accounts were written up by eyewitnesses for the purpose of presenting a novel medical technique which might be useful to fellow practitioners.[10]

Addressed to the Royal College of Physicians; by Christopher Caustic, M.D., A.S.S., 2nd American ed. (Philadelphia: Lorenzo Press, 1806), Jennie June, "Jennie June's Letters," *The United States Democratic Review*, Jun 1858, 469-472, G. P. Morris and N. P. Willis, "Diary of Town Trifles," *The New Mirror*, April 6 1844, 8-9, Nil Admirari, "Fine Feeling," *The New-York Mirror: a Weekly gazette of literature and fine arts* 2, no. 29 (1825): 230, Quillet Quiz, "Nitrous Oxide Gas.," *The Philadelphia Reportory Devoted to Literature and Useful Intelligence* 41, no. 2 (1812): 325-326, S., "On the Effects of the Nitrous Oxide.," *The Port-Folio* 6, no. 1 (1811): 44-47.

[10] George T. Barker, *Instructions in the Preparation, Administration, and Properties of Nitrous Oxide, Protoxide of Nitrogen, or Laughing Gas* (Philadelphia: Rubencame and Stockton, 1866), Henry Jacob Bigelow, "Insensibility During Surgical Operations Produced by Inhalation," *Boston Medical & Surgical Journal* 35 (1846): 309-317, Henry Jacob Bigelow, "Nitrous Oxide Gas for Surgical Purposes in 1848.," *Boston Medical & Surgical Journal* 72 (1868): 6-10, John P. Harrison, "On the Physiology, Pathology, and Therapeutics of Pain.," *Western Lancet* 9 (1849): 349-354, Charles T. Jackson, *Manual of Etherization* (Boston: Mansfield, 1861), W. T. G. (William Thomas Green) Morton, *Morton's Letheon Circular*, 5 ed. (Boston: [privately printed], 1847), Valentine Mott, *Pain and Anaesthetics: An Essay Introductory to a Series of Surgical and Medical Monographs, Prepared by Request of the Sanitary Commission* (Washington, DC: M'Gill & Witherow, 1863), Valentine Mott, "Remarks on the Importance of Anaesthesia from

The second type of account revolved around the priority debate, and consisted of arguments assigning the discovery or invention of inhalation anesthesia to one or another individual. These arguments tended to devolve into character studies of both Morton and Wells emphasizing their inclusion or exclusion from the medical establishment. These texts shifted the focus from the technical aspects of inhalation anesthesia to the larger issue of which individual would go down in history for creating the idea of painless surgery through inhalation. In this sense we can begin to see the importance that the larger social context played in the writing of anesthetic history. Producing a series of highly biased and polemic arguments, the authors of these tracts were often experimenters themselves, such as Wells, Morton, Charles T. Jackson and Gardner Quincy Colton. Additionally, friends of the various proponents and witnesses to some of the demonstrations were called upon to write their accounts of the events, slanted towards demonstrating the priority of one individual over another.[11]

Chloroform in Surgical Operations, Illustrated by Two Cases.," *Transactions of the New York Academy of Medicine* 1 (1847-1857): 85-95, E. R. Smilie, *An Address Delivered before the Class of the Castleton Medical College on the Original Application of Anaesthetic Agents* (Boston: Jewett & Co., 1848), Mayo G. Smith, *A Treatise on the Inhalation of Ether for the Prevention of Pain* (Boston: J.P. Jewett, 1848), John Collins Warren, *Etherization: With Surgical Remarks* (Boston: William D. Ticknor & Company, 1848), G. J. Ziegler, "Experimental Investigations on the Antidotal and Revivifying Properties of Nitrous Oxide.," *Boston Medical & Surgical Journal* 47 (1852): 383-392.

[11] Henry J. Bigelow, "A History of the Discovery of Modern Anesthesia," *American Journal of the Medical Sciences* 71 (1876): 164-184, Richard H. Dana, "A History of the Ether Discovery. Report of the Massachusetts General Hospital," *Littell's Living Age*, no. 201 (1848): 529-571, James A. Dorr, "The Original Discoverer of the Application of Ether to Surgical Operations. To the

Another type of historical resource related to nitrous oxide during the Nineteenth-Century consists of articles and advertisements for popular demonstrations of the gas.

Editor of the Lancet.," *Lancet* 49, no. 1228 (1847): 289-290, (J. Wales on behalf of friends of the late Dr. H. Wells). *Discovery by the Late Dr. Horace Wells of the Applicability of Nitrous Oxyd Gas, Sulphuric Ether and Other Vapours in Surgical Operations (Nearly Two Years before the Patented Discovery of Drs. Charles T. Jackson and W.T.G. Morton.)* (Hartford: Elihu Geer, 1852), James McManus, *Notes on the History of Anaesthesia : The Wells Memorial Celebration at Hartford, 1894: Early Record of Dentists in Connecticut* (Hartford: Clark & Smith, 1896), W. T. G. (William Thomas Green) Morton, "Letheon," (United States: 1846), William J. Morton and William T. G. Morton, *The Invention of Anaesthetic Inhalation; or, "Discovery of Anaesthesia."* (New York: D. Appleton and Company, 1880), Nathan P. Rice, "A Grain of Wheat from a Bushel of Chaff.," *Knickerbocker, New-York Monthly Magazine* 3 (1859): 133-138, Nathan P. Rice, *Trials of a Public Benefactor : As Illustrated in the Discovery of Etherization* (New York: Pudney & Russell, 1858), Truman Smith, *An Examination of the Question of Anaesthesia : Arising on the Memorial of Charles Thomas Wells, Presented to the United States Senate, Second Session Thirty-Second Congress, and Referred to a Select Committee, of Which the Hon. Isaac P. Walker Is Chairman / Prepared for the Information of Said Committee, by the Hon. Truman Smith, U.S. Senator from Connecticut.* (New York: John A. Gray, 1858), Truman Smith and P. W. Ellsworth, *An Inquiry into the Origin of Modern Anaesthesia* (Hartford, CT: Brown and Gross, 1867), Hon. Edward of NC Stanley and Hon. Alexander of MD Evans, "Report to the House of Representatives of the United States of America Vindicating the Rights of Charles T. Jackson to the Discovery of the Anaesthetic Effects of Ether Vapor and Disproving Claims of W.T.G. Morton to That Discovery.," (House of Representatives: Printed by the authority of the Minority of the Select Committee on the Ether discovery, 1852), U.S. 30th Congress Second Session, "Wm. T. G. Morton, M.D.--Sulphuric Ether," (House of Representatives, 1849), Mr. Walker, "Report: In Senate of the United States," (32nd Congress, Second Session, 1853), Horace Wells, *A History of the Discovery of the Application of Nitrous Oxide Gas, Ether, and Other Vapors, to Surgical Operations* (Hartford: J. Gaylord Wells, 1847), Horace Wells, "Original Discoverer of the Application of Etherization to Surgery," *Lancet* 49, no. 1235 (1847): 471-474.

The extensive use of these heretofore untapped documents, the result of extensive primary resource research, is one of the novel aspects of this thesis. Advertisements for exhibitions and reviews of performances involving the gas tell us how nitrous oxide had a life outside of chemical and medical culture.

The last set of primary source material tells us about how nitrous oxide was introduced into dental practice during the 1860s. Between 1850 and 1870 there were hundreds of advertisements for nitrous oxide in the *New York Times* and *Brooklyn Daily Eagle* placed by Gardner Quincy Colton. A survey of these advertisements chronicles the introduction of the gas into dental practice. By reviewing Colton's use of nitrous oxide simultaneously in laughing gas exhibitions and dental clinics, we see how the gas recovered its respectability lost by Davy at the turn of the century.[12]

Recent Histories of Anesthesia

Professor of Anesthesiology Norman A. Bergman writes prolifically on the early uses of gases that consequently were used as anesthetics.[13] For example, in an article on

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[12] Cf. The hundreds of classified ads found in the *New York Times* 1850-1870, and *Brooklyn Daily Eagle* 1850-1870. Cf. also texts found in medical resources, such as Gardner Quincy Colton, *Anaesthesia. Who Made and Developed This Great Discovery? A Statement Delivered Upon the Mellowing of Occasion* (New York: A. G. Sherwood & Co., 1886), Gardner Quincy Colton, "Experience in the Use of Nitrous Oxide Gas," *British Journal of Dental Science* 11 (1868): 251-257, Gardner Quincy Colton, "Nitrous Oxide," *Monthly review of dental surgery* 2 (1873-74): 26-30, Gardner Quincy Colton, "Nitrous Oxide Gas an Anaesthetic," *Dental Cosmos* 5, no. 9 (1864): 490.

[13] Cf. Norman A. Bergman, "The Earliest Description of Nitrous Oxide Narcosis: Columbia University's Contribution to the Discovery of Anesthesia," *Seminars in Anesthesia* 4 (1986): 253-

Humphry Davy's nitrous oxide use, Bergman argues that there were physical and technological limitations to the depth of surgical sleep nitrous oxide could produce in the 1790s which prevented the gas from being used to achieve anesthesia.[14] Bergman claims that because Davy did not manage to use nitrous oxide to achieve a state of unconsciousness, he must not have been capable of rendering a person unconscious from nitrous oxide inhalation. Bergman cites physical and technical restrictions in the production and administration of the gas as the reason unconsciousness was impossible to achieve at that point in time. Bergman's assumption that Davy never achieved unconsciousness is suspicious in light of Davy's own testimony about the gas. Another article by Bergman betrays a bias against social and cultural historical sources, as well as his tendency to categorize nitrous oxide completely in medical terms.[15] In this article,

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254, Norman A. Bergman, "Forerunners of Modern Anesthesiology: Dwarfs and Giants," *Pharos* 48 (1985): 8-12, Norman A. Bergman, "Frivolous Uses of Anesthetic Gases : Some Historical Aspects," *American Society of Anesthesiologists newsletter* 59, no. 11 (1995): 18-19, Norman A. Bergman, *The Genesis of Surgical Anesthesia* (Park Ridge, IL: Wood Library-Museum of Anesthesiology, 1998), Norman A. Bergman, "Humphry Davy's Contribution to the Introduction of Anaesthesia: A New Perspective.," *Perspectives in Biology and Medicine* 34 (1991): 534-541, Norman A. Bergman, "Samuel Latham Mitchill (1764-1831). A Neglected American Pioneer of Anesthesia," *Journal of the American Medical Association* 253, no. 5 (1985): 675-678.

[14] Norman A. Bergman, "Humphry Davy's Contribution to the Introduction of Anaesthesia: A New Perspective.," *Perspectives in Biology and Medicine* 34 (1991): 534-541.

[15] Norman A. Bergman, "Frivolous Uses of Anesthetic Gases : Some Historical Aspects," *American Society of Anesthesiologists newsletter* 59, no. 11 (1995): 18-19.

published in a journal of anesthesiology, Bergman claims that nitrous oxide was scientifically and medically insignificant, a mere party favor.

> The most extensive application of nitrous oxide during the first half of the nineteenth century was its frivolous use for producing a state of inebriation to provide enjoyment both for inhalers of the gas, who usually experienced remarkable mental sensations, and spectators, who were greatly amused by the antics of those who partook of the intoxicant substance.[16]

Bergman's characterization of nitrous oxide during this period is technically correct, however his categorizing this use of nitrous oxide as "frivolous" reflects a historian's category. This tells us nothing about what individuals during the Nineteenth-Century thought about how nitrous oxide was used, although it does tell us what today's anesthesiologist would consider to be a "frivolous" use of the gas.

Richard Gunderman, lecturer in Biological Sciences at the University of Chicago, presents a revisionist history of Horace Wells' 1844 demonstration of nitrous oxide at the Massachusetts General Hospital.[17] His is a narrative which makes no attempt to understand the reasons why Wells' demonstration was a failure, but serves to vindicate Wells' memory as a heroic pioneer of anesthesia by portraying him dramatically as a man who carried on against great odds. By valorizing Wells in what appears to be an uncritical way, Gunderman misses an opportunity to offer new explanations or ideas

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[16] Norman A. Bergman, "Frivolous Uses of Anesthetic Gases : Some Historical Aspects," *American Society of Anesthesiologists newsletter* 59, no. 11 (1995): 18.

[17] Richard B. Gunderman, "Dr. Horace Wells and the Conquest of Surgical Pain: A Promethean Tale," *Perspectives in Biology and Medicine* 35 (1992): 531-548.

about why Wells' demonstration was considered to be a failure, especially since he is arguing that this was indeed the first public display of anesthesia.

The majority of literature from the second half of the twentieth century consists of the history of anesthesiology from the perspective of the professional anesthesiologist. The focus of this research is a reassessment of the primary source material with the implied purpose of delineating anesthesiology as a discipline with a history unique from that of surgery or dentistry. W. D. A. Smith produced an anthology of his previously published essays on nitrous oxide entitled *Under the Influence.* In these essays Smith presents detailed historical data about the use and production of nitrous oxide anesthesia. Smith catalogs the period dating from the isolation of the gas by Priestly in late 1793 to its early twentieth century medical usage. The advantage here is that Smith does not make the usual assumption that ether, chloroform, and nitrous oxide may all be analyzed as historically equivalent substances in a progressive history of anesthesia. Because Smith details the use of nitrous oxide and does not include ether, chloroform and other anesthetic substances in his research, he provides ample material to trace the history of this substance. Although Smith does address Wells' failure in Boston, he offers only two paragraphs on the subject in his 180 page book. Smith quotes Wells directly, taking as unproblematic Wells' explanation that he failed because he made an error when administering the gas.[18] Smith's lack of exploration into Wells' failure leaves its explanation open to further examination.

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[18] W. D. A. Smith, *Under the Influence: A History of Nitrous Oxide and Oxygen Anaesthesia* (London: Macmillan Publishers, 1982), 57.

One of the most often cited historical works by an anesthesiologist is F. F. Cartwright's *The English Pioneers of Anesthesia: Beddoes, Davy and Hickman.*[19] On the positive side, Cartwright relies almost exclusively on primary sources to drive his narrative, including Davy's handwritten notebooks, and presents a detailed textual analysis of those sources. However, all of this is done through the lens of a practicing anesthesiologist, resulting in pronouncements of "correct" and "incorrect" findings as well as small sidebars in the narrative, addressed to his contemporry peers. When discussing Davy's conclusions about his nitrous oxide experiments at Bristol in Davy's *Researches*, Cartwright argues that Davy achieved modern anesthetic states.

> Making due allowance for the archaic phraseology, surely there can be no better summing-up of the effects of nitrous oxide than this. It is true that he does not mention loss of consciousness, but his 'alteration of the condition of the organs of sensation' must at least imply analgesia, if not anesthesia.[20]

Cartwright is anachronistic in attributing "analgesia," a state which had not yet been invented, to Davy. Cartwright additionally points out how Davy's observations can be understood as highlighting "...facts that are well known to anaesthetists to-day."[21] Statements such as these betray the fact that Cartwright is examining the sources with an eye towards what is understood as valid and useful in contemporary society: he is

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[19] F. F. Cartwright, *The English Pioneers of Anesthesia (Beddoes, Davy, Hickman).* (Bristol: John Wright, 1952).

[20] F. F. Cartwright, *The English Pioneers of Anesthesia (Beddoes, Davy, Hickman).* (Bristol: John Wright, 1952), 228.

[21] F. F. Cartwright, *The English Pioneers of Anesthesia (Beddoes, Davy, Hickman).* (Bristol: John Wright, 1952), 230.

practicing a selective sort of historical interpretation that must be looked at by modern historians with a suspicious eye.

Upon reflection of contemporary work on the history of inhalation anesthesia, the distinctions between those histories written from the perspective of the dental profession, as contrasted with those written from the perspective of the surgical profession, come to light. The dental-centered histories tend to discuss in great detail the contribution made by Horace Wells, his initial experiments and his first attempt to demonstrate nitrous oxide's use in surgery.[22] Histories written by contemporary surgeons, in contrast and not surprisingly, tend to spotlight Morton and his initial demonstrations at Massachusetts General Hospital. For example, take dental historian R. King, who discusses the dangers of making interpretive assumptions when looking at cultural, not professional representations of what we may believe to be dental history. In "Curing Toothache on

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[22] W. Harry Archer was a dentist who has concentrated his historical work on Horace Wells. Cf. W. H. Archer, "Dr. Horace Wells, Dentist, Who First Discovered, Demonstrated and Proclaimed the Blessings of Surgical Anesthesia," *N Y J Dent* 39, no. 10 (1969): 458-460, W. Harry Archer, *Chronological History of Horace Wells, Discoverer of Anesthesia* ([n.p.,: 1939), W. Harry Archer, *Historical Notes on Horace Wells* ([n.p.,: 1939), W. Harry Archer, *Horace Wells Dishonored in Renâe Fèulèop-Miller's Book "Triumph over Pain"* ([n.p.]: American Society for the Advancement of General Anesthesia in Dentistry, 1940), W. Harry Archer, "Life and Letters of Horace Wells, Discoverer of Anesthesia, Chronologically Arranged, with an Appendix.," *Journal of the American College of Dentists* 11, no. 2 (1944): 89-200, W. Harry Archer, Milton Baron Asbell, and William B. Irby, *The History of the Development of Anesthesia, Oral Surgery and Hospital Dental Service in the United States of America. [by] Archer, Asbell [and] Irby* ([Pittsburgh, Pa.]: 1971), W. Harry Archer, Elizabeth Wells, and Horace Wells, *Letters of Dr. And Mrs. Horace Wells Discovered* ([n.p.,: 1940).

the Stage? The Importance of Reading Pictures in Context,"[23] King argues that what might appear to be a popular image of a early dental extraction in the Eighteenth-Century is but a representation of a charlatan, and consequently has little to do with the history of medicine or dentistry. To King, extracting teeth and the "science" of dentistry are two very different things, and these extractions have little to do with the development of oral science. The author assumes that our current disciplinary boundaries can be applied to the past, separating out charlatans from professionals. King's work is an example of a history of dentistry which rests on the latent idea that temporally static disciplinary boundaries separate the professional dentist from the charlatan. This interpretation underestimates the complex negotiations on the part of dentists for professional status that occurred throughout the Nineteenth-Century.[24] King's work serves as a warning to the dangers of reading present professional categories into the past.

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[23] Roger King, "Curing Toothache on the Stage? The Importance of Reading Pictures in Context.," *History of Science* 33 (1995): 396-416.

[24] Joan Burbick, *Healing the Republic : The Language of Health and the Culture of Nationalism in Nineteenth-Century America, Cambridge Studies in American Literature and Culture ; 82* (Cambridge [England] ; New York, NY, USA: Cambridge University Press, 1994), John C. Burnham, *How the Idea of Profession Changed the Writing of Medical History, Medical History Supplement ; No 18* (London: Wellcome Institute for the History of Medicine, 1998), W. F. Bynum and Roy Porter, eds., *Medical Fringe & Medical Orthodoxy: 1750-1850* (London: Croom Helm, 1987), A. I. Marcus, "From Individual Practitioner to Regular Physician: Cincinnati Medical Societies and the Problem of Definition among Mid-Nineteenth-Century Americans.," in *Technical Knowledge in American Culture: Science, Technology and Medicine since the Early 1800s*, ed. H. Cravens, A. I. Marcus, and D. M. Katzman (Tuscaloosa, AL: University of Alabama Press, 1996), W. G. Rothstein, *American Medical Schools and the*

In one of the more recent additions to the literature on anesthesia history, Richard Wolfe claims that Wells' demonstration was a failure because he chose the wrong substance.[25] Wolfe presents yet another pro-Wells history of anesthesia. He explains the failure of the nitrous oxide demonstration by claiming that ether induced deeper muscle relaxation and was consistently easier to prepare and store. However, this cannot explain the initial failure of Well's experiment. The ether demonstration occurred two years after that of Wells. It was not a matter of comparing the efficacy of two objects and determining the better one. Wells demonstrations did not fail only in comparison with the ether demonstration, it failed outright at the time it occurred.

Victor Robinson, M.D., presents in his *Victory Over Pain* the history of anesthesia as progressive, leading to better and more refined techniques and technologies. Robinson writes in a melodramatic style, embellishing historical records for dramatic purposes. He characterizes Wells' failure:

Practice of Medicine: A History (New York: Oxford University Press, 1987), John Harley Warner, "The History of Science and the Sciences of Medicine: Constructing Knowledge in the History of Science," *Osiris* 10, no. 2 (1995): 164-193, John Harley Warner, "Power, Conflict, and Identity in Mid-19th-Century American- Medicine - Therapeutic Change at the Commercial Hospital in Cincinnati," *Journal of American History* 73, no. 4 (1987): 934-956, John Harley Warner, *The Therapeutic Perspective: Medical Practice, Knowledge and Identity in America 1820-1885* (Princeton, NJ: Princeton University Press, 1997), James H. Young, *American Health Quackery: Collected Essays by James Harvey Young* (Princeton, NJ: Princeton University Press, 1992).

[25] Richard J. Wolfe, "Who Was the Discoverer of Surgical Anesthesia? A Brief for Horace Wells.," in *I Awaken to Glory: Essays Celebrating Horace Wells*, ed. Richard J. & Menczer Wolfe, Leonard F. (Boston: Boston Medical Library, 1994), 1-72.

> The students jeered, hissed and shouted "Humbug!" Wells was driven from the hospital amphitheater a dejected figure, his head bowed and his eyes unseeing. The patient himself declared later that he had felt no pain, but Wells himself was convinced that he had failed.[26]

Robinson offers no explanation for the behavior of those at Wells' demonstration, implying that Wells must have made an error administering the gas, even as he dramatizes the events. Robinson's narrative exemplifies the dangers of a progressive historical stance, offering little in terms of explaining failure, but emphasizing and lauding success.

Although these histories present detailed descriptions of past events, and have unearthed a wealth of primary source materials, they tell us very little about the history of nitrous oxide and ether apart from the medical profession. These historians fail to mention the larger social and cultural factors at play in the history of anesthesia. Although detailed and generally historically consistent, we need to look to the professional historians if we are to understand the social and epistemological ramifications of early nitrous oxide and ether use.

Social and Intellectual History

Various historians have addressed aspects of the history of nitrous oxide with wide-ranging results. Julie M. Fenster presents an interesting new interpretation of the

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[26] Victor Robinson, *Victory over Pain, a History of Anesthesia* (New York: Schuman, 1946), 104.

introduction of anesthesia in her recent book, *Ether Day.*[27] Although she implies that the unique character of nitrous oxide may have contributed to Wells' initial failure in Boston, Fenster concentrates on exploring the contingent nature of Morton's success. The novelty in Fenster's work is that she has unearthed evidence that Morton was in fact nothing more than a confidence man.

> William Morton's career as a scoundrel was rarely mentioned publicly during the rest of his life, and it is omitted from most histories to this day...Those qualities should not be concealed. If he had not been "bold and assuming," to use the words of one of his early accusers--"impetuous, unremitting, and reckless," in the words of a surgeon at Mass General--then he would never have carried off Ether Day, which was, in William Morton's hands, the greatest confidence game of the whole century.[28]

Fenster then explains how this "scoundrel" was able to enlist the support of medical professionals at Massachusetts General Hospital in order to make Letheon a success, suggesting that Morton's engaging charisma and ability to manipulate those around him explains his reputation as the originator of surgical anesthesia. Fenster focuses on the biographical details of individuals involved in the introduction of anesthesia. Her work is unique in its strong polemical stance against Morton, who is not generally so strongly demonized in the literature. Further, although her argument explaining Morton's success is convincing, she remains vague on Wells' failure. She implies that Wells' lack of cold-hearted ambition and his kind and trusting personality doomed him to failure. Fenster's

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[27] Julie M. Fenster, *Ether Day: The Strange Tale of America's Greatest Medical Discovery and the Haunted Men Who Made It*, 1st ed. (New York: HarperCollins, 2001).

[28] Julie M. Fenster, *Ether Day: The Strange Tale of America's Greatest Medical Discovery and the Haunted Men Who Made It*, 1st ed. (New York: HarperCollins, 2001), 93-94.

argument works when applied to the question of why Wells was not credited with the invention of anesthesia in his lifetime, but she does not explain his early failure to convince his medical student audience of the efficacy of nitrous oxide in 1845 in terms of his personality.

Other historians have tended to include the Nineteenth-Century American social context and intellectual tendencies when producing their accounts of anesthesia's beginnings. Martin S. Pernick focused on the attitude of professional medical practitioners and how they decided who was eligible for anesthesia, once ether had been adopted for surgery. He discusses the selective use of anesthesia during the period from 1850-1865, primarily focusing on ether and chloroform use. According to Pernick, physicians applied a "calculus," quantifying subjective factors such as class and social standing, in order to decide if a patient merited anesthesia.

> These techniques, combining recent advances in calculus and probability theory with the utilitarian ethics of [Jeremy] Bentham, allowed physicians to measure the risks and benefits of a drug, without invoking such ethical absolutes as the traditional injunction to "do no harm."...the physician's task was to compare directly the objective statistical magnitude of each harm regardless of its source and act so as to maximize the overall benefit to the patient.[29]

Pernick's primary concern is the evolution of professionalism in medicine rather than the development of anesthesia or overall use of anesthetic substances. His work locates pain relief and the decision making procedures that developed as a result of the introduction of

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[29] Martin S. Pernick, *A Calculus of Suffering: Pain, Professionalism, and Anesthesia in Nineteenth-Century America.* (New York: Columbia University Press, 1985), 99.

inhalation anesthesia as the catalyst that initiated medical professionalism. He characterizes anesthesia and medical attempts to control surgical pain as the locus of control medical practitioners used to distinguish amateur from professional, emphasizing how the burgeoning control over surgical pain gave practitioners power to establish themselves as medical scientists. Successful as he is in this regard, Pernick however fails to distinguish between different anesthetic substances, thus leaving questions about Wells' failure and Morton's success open for interpretation.

Understanding the social aspects of chemical research has been helpful in situating nitrous oxide use in greater cultural environs. Jan Golinski's *Science as Public Culture* is an invaluable example of a project which focuses almost exclusively on the social factors that influenced nitrous oxide.[30] Golinski concentrates on British chemistry, emphasizing the cultural aspects of chemical use and chemical demonstration during the earliest part of the Nineteenth-Century. Golinski stations his work within the literature of other the historian-sociologists of science such as Peter Dear and Steven Shapin, further emphasizing his nearly exclusive use of social factors as explanatory historical causes. Golinski uses chemistry in Britain at the turn of the Nineteenth-Century in order to contextualize the emergence of scientific knowledge as a public, cultural practice. I expand Golinski's ideas onto the American scene during the Nineteenth-Century, and explore how the public creation of knowledge and cultural uses of nitrous oxide effected the results of Wells' 1845 demonstration in Boston.

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[30] Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820.* (Cambridge: Cambridge University Press, 1992).

Alison Winter characterizes anesthesia history in a very peculiar way in her works on mesmerism.[31] The main problem with Winter's characterization of anesthesia is that she effectively treats ether, chloroform and nitrous oxide as identical historical substances.

> The practice of inhaling the vapour of sulphuric ether for medical or recreational purposes was widely popularized during the early nineteenth century as a substitute for nitrous oxide in pneumatic medicine and in popular science demonstrations.[32]

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[31] A. Winter, "Ethereal Epidemic - Mesmerism and the Introduction of Inhalation Anesthesia to Early Victorian London," *Social History of Medicine* 4, no. 1 (1991): 1-27, A. Winter, "Mesmerism and Popular-Culture in Early Victorian England," *History of Science* 32, no. 97 (1994): 317-343, Alison Winter, *Mesmerized : Powers of Mind in Victorian Britain* (Chicago: University of Chicago Press, 1998).

[32] A. Winter, "Ethereal Epidemic - Mesmerism and the Introduction of Inhalation Anesthesia to Early Victorian London," *Social History of Medicine* 4, no. 1 (1991): 18. This statement is problematic when one examines Winter's sources for this claim. Winter cites both W.D.A. Smith's work on the history of nitrous oxide and Christopher Lawrence's article "The Power and the Glory: Humphry Davy and Romanticism," as sources for her likening of nitrous oxide and ether use at the beginning of the Nineteenth-Century. However upon examination, neither of these sources actually equivocates ether and nitrous oxide; in fact, both articles refer exclusively to nitrous oxide use This statement is problematic when one examines Winter's sources for this claim. Winter cites both W.D.A. Smith's work on the history of nitrous oxide and Christopher Lawrence's article "The Power and the Glory: Humphry Davy and Romanticism," as sources for her likening of nitrous oxide and ether use at the beginning of the Nineteenth-Century. However upon examination, neither of these sources actually equivocates ether and nitrous oxide; in fact, both articles refer exclusively to nitrous oxide use. Christopher Lawrence, "The Power and the Glory: Humphry Davy and Romanticism," in *Romanticism and the Sciences*, ed. A. Cunningham and N. Jardine (Cambridge: Cambridge University Press, 1990). W. D. A. Smith, *Under the Influence: A History of Nitrous Oxide and Oxygen Anaesthesia* (London: Macmillan Publishers, 1982).

Winter continues the error in her book, *Mesmerized.* She assumes that both ether and nitrous oxide were displayed publicly in identical ways, and that nitrous oxide was adopted as an unproblematic substitute for ether in surgical operations from the 1840s because it was simply a more potent painkiller.[33] Equivocating nitrous oxide and ether has ramifications on the direction and character of historical narrative. As Smith's work has shown, nitrous oxide has a different historical development and use than that of ether. Winter's scholarship on mesmerism may in fact be quite competent, but her historical assumptions about disparate chemical substances remain suspect.

Stephanie Browner's recent work focuses on the relationship between Morton, his most vocal advocate Henry J. Bigelow, and the professional medical community at the time of Morton's Letheon demonstration.[34] Browner attributes Morton's success in 1846 to his relationship with Bigelow, and further explains how Bigelow appealed to a populist sense of Jacksonian egalitarianism in order to make the lowly dentist's ideas palatable to Boston professionals. By focusing on the tension between medical amateurs and medical professionals, Browner demonstrates how the early uses of Letheon functioned as a demarcation between the amateur and professional medical practitioner. Like Fenster, Browner attributes Morton's success to his ability to cultivate a strong relationship with Bigelow, his escape from common dentistry, and eventual entrée into the Boston medical scene. Browner's excellent article serves to unpack many of the

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[33] Alison Winter, *Mesmerized : Powers of Mind in Victorian Britain* (Chicago: University of Chicago Press, 1998), 166.

[34] Stephanie Browner, "Ideologies of the Anesthetic: Professionalism, Egalitarianism and the Ether Controversy.," *American Quarterly* 51, no. 1 (1999): 108-143.

complicated professional debates which hinged on Morton's early anesthetic demonstrations.

As we have seen, historians such as Pernick and Browner have homed in on the debates over professionalism in medicine and how the introduction of anesthesia played into these debates. This thesis will not attempt to modify these arguments, but assumes the validity of this characterization of medical professionalism in the Nineteenth-Century. These and additional studies on the development of medical professionalism serve to contextualize Wells' failure and Morton's success. Additionally, there are a number of tangentially related works that can help to situate and contextualize the new arguments and evidence presented in the following thesis. Turf wars over professional boundaries were fought in the arena of anesthesia history, and the credit for inventing anesthesia was the brass ring.[35]

The Use of Pain

Changing attitudes about pain in the Nineteenth-Century are inevitably linked by historians to the development of surgical anesthesia. One assumption sometimes

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[35] Cf. Kenneth Allen De Ville, *Medical Malpractice in Nineteenth-Century America: Origins and Legacy.*, ed. James Kirby Martin, *American Social Experience Series, No 19* (New York: New York University Press, 1990), A. I. Marcus, "From Individual Practitioner to Regular Physician: Cincinnati Medical Societies and the Problem of Definition among Mid-Nineteenth-Century Americans.," in *Technical Knowledge in American Culture: Science, Technology and Medicine since the Early 1800s*, ed. H. Cravens, A. I. Marcus, and D. M. Katzman (Tuscaloosa, AL: University of Alabama Press, 1996), W. G. Rothstein, *American Physicians in the Nineteenth Century: From Sects to Science* (Baltimore, MD: Johns Hopkins University Press, 1992).

embraced by historians of anesthesia is that pain has universally and across time been regarded as something to be avoided. Recent scholars have raised a metaphorical eyebrow at this assumption, and social and cultural historians have taken up the challenge of historicizing the problem of pain. They present the culture of pain deterrence as one that emerged from within a complex social and political network, rather than as a universal given. One of the major problems of the literature has been the challenge of explaining why surgical pain became an important medical problem during the first part of the Nineteenth-Century. These multiple historical characterizations of pain are beyond the scope of this thesis; a topic in and of itself worthy of extended research. However, it is still helpful to review what recent scholars have claimed about historically shifting attitudes about pain.

Roselyne Rey's *History of Pain* is probably the most comprehensive academic history of all things related to physical pain.[36] Rey's work, originally published in French, is thorough but uses almost exclusively French language resources and focuses on pain in France and to a lesser extent England. Rey is one of the few historians who upon examining the work of the Pneumatic Institution rightly concludes that these early experiments and treatments with gases were fundamentally different from explorations into the character and problems of pain. Rey also points out that some of the reasons generally presented for the so-called delayed adoption of anesthesia (purification, dosage, and duration of administration) were historically coincidental, and not in any way primary historical causes of the delay. She emphases the idea that these technical issues were

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[36] Roselyne Rey, *The History of Pain* (Cambridge, MA: Harvard University Press, 1995).

resolved not just when medical practitioners viewed them as problems to be remedied, but when society as a whole was able to assimilate invasive surgical procedures into the arena of acceptable, and eventually routine, medical practice.

Since patent medicine trends reflected the Nineteenth-Century marketplace, it is necessary to examine the history of patent medicines in the United states in order to find out how the public demand for pain mitigating substances emerged and developed over time. James Young wrote the seminal history of patent medicines, *The Toadstool Millionaires.*[37] Especially interesting in this work are Young's characterizations of attempts at painkilling prior to the Nineteenth-Century, leading one to speculate on how these attempts may have changed prevailing attitudes about pain, or even possibly reflected them. Unfortunately, this work emphasizes the post-Victorian patent medicine era, leaving open analysis of nostrums during the antebellum era.

Some historians have linked larger trends in cultural attitudes about pain and the Romantic Movement when explaining early resistance to and the eventual adoption of inhalation anesthesia. Donald Caton examines some assumptions about pain relief and

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[37] Cf. J. H. Young, "Folk into Fake + Medicine," *Western Folklore* 44, no. 3 (1985): 225-239, James H. Young, *American Health Quackery: Collected Essays by James Harvey Young* (Princeton, NJ: Princeton University Press, 1992), James H. Young, *The Toadstool Millionaires: A Social History of Patent Medicines in the United States before Federal Regulation* (Princeton, NJ: Princeton University Press, 1961), James Harvey Young, "Patent Medicines and the Self-Help Syndrome," in *Sickness & Health in America: Readings in the History of Medicine and Public Policy*, ed. J. W. Leavitt and Ronald L. Numbers (Madison, WI: University of Wisconsin Press, 1986).

the beginnings of the use of anesthesia.[38] He claims that there were additional social and medical factors that historians should take into consideration when examining the introduction of anesthesia. Caton emphasizes that religious imperatives about pain were prevalent in the late Eighteenth and Nineteenth-Century in both Europe and America. Pain was considered to be a just punishment from God, and attempts to mitigate it were understood as a negative interference with divine will. Using anesthesia to quell childbirth pains was especially problematic, in that it explicitly contradicted biblical mandate stipulating that this pain was just punishment for Eve and her female descendents because of woman's original fall from grace. Caton's analysis of anesthesia and childbirth shows how commonly held beliefs may have directly affected medical practice. Caton rightly concludes that anesthesia was only possible once a given society that believed in the value of pain relief and was able to sidestep or even ignore dogmatic reliance on fundamentalist biblical interpretation .

Emmanuel Papper emphasized the role that the Romantic Movement of the late Eighteenth-Century played in shifting Nineteenth-Century attitudes about pain.[39] Papper

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[38] Donald Caton, *What a Blessing She Had Chloroform : The Medical and Social Response to the Pain of Childbirth from 1800 to the Present* (New Haven, Conn.: Yale University Press, 1999).

[39] E. M. Papper, "The Discovery of Anesthesia - a Romantic Achievement," *Seminars in Anesthesia* 8, no. 3 (1989): 255-262, E. M. Papper, "The Influence of Romantic Literature on the Medical Understanding of Pain and Suffering - the Stimulus to the Discovery of Anesthesia," *Perspectives in Biology and Medicine* 35, no. 3 (1992): 401-415, Emanuel M. Papper, "Pain, Suffering and Anesthesia in the Romantic Period" (University of Miami, 1990).

believes that as a result of the Romantic Movement, pain was no longer understood to be a necessary aspect of life.

> That there was no longer a need to view pain and suffering as the punishment for sin; that there was no need to view pain and suffering as the consequences of fate; that there was no need to think of pain and suffering as being a necessary component of human frailty and the mortal condition; that there was no need, finally, to accept pain and suffering as a normal part of life.[40]

Papper's thesis is simple: the ideas of romantic subjectivism were necessary in order for the alleviation of pain to become a medical concern. He traces the emerging importance of the individual and subjective sensations through the Romantic Literature of the late eighteenth and early Nineteenth-Century. Papper supports his thesis by examining the writings of Thomas Beddoes, Samuel Taylor Coleridge, and Percy Bysshe Shelley, concluding that their emphasis on the sensations of the individual and personal experience were necessary preconditions to the medicalization of pain. Margaret Jacob and Michael Saunter disagree with Papper's conclusions. Although they agree with Papper's characterization of Beddoes, Coleridge and Shelly as central British Romantics, they rightly point out that Papper's thesis cannot explain why anesthesia was not adopted until nearly two generations after these intellectuals thrived.[41]

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[40] E. M. Papper, *Romance, Poetry, and Surgical Sleep: Literature Influences Medicine, Contributions in Medical Studies, No 42* (Westport, CT: Greenwood Press, 1995), 34.

[41] M. C. Jacob and M. J. Sauter, "Why Did Humphry Davy and Associates Not Pursue the Pain-Alleviating Effects of Nitrous Oxide?," *Journal of the History of Medicine and Allied Sciences* 57, no. 2 (2002): 163.

Karen Halttunen presents a social history of the development of attitudes about pain during the Nineteenth-Century in her article about pain aversion in Nineteenth-Century American culture.[42] Although her focus on the interplay between sexuality, gender, pain and power is insightful, Halttunen glosses over anesthesia, not connecting the developing attitudes about pain with the developing need for a way to alleviate medically induced pain.[43] Halttunen identifies the Eighteenth-Century as the time where

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[42] Karen Halttunen, "Humanitarianism and the Pornography of Pain in Anglo-American Culture," *American Historical Review* 100, no. 2 (1995): 303-334. One strange and interesting aspect of this article is how Halttunen has characterized Benjamin Rush, proponent of "heroic medicine" and advocate of inflicting pain in the fight of disease, as a sentimental humanitarian reformer who thought the *public* infliction of pain to be a social evil. Halttunen categorized Rush as one of the leading opponents of public capital punishment. Rush, the primary proponent in the United States during the Eighteenth-Century of what was known as heroic medicine, claimed that repeated viewings of human suffering led to a desensitization of the viewer, arousing a positive taste for cruelty. Halttunen does not notice any contradiction between what Rush claims about public viewing of pain and his advocacy of "heroic" medicine, in which one of the primary principles is the infliction of pain for the greater benefit of a medical cure. On Halttunen's approach, Rush would have to admit that heroic dosing causes doctors to be desensitized and even arouses in medical professionals a positive taste for observing cruelty. It is highly unlikely that Rush believed this about medical practitioners. The question then remains as to how Rush could simultaneously hold that repeated exposure to cruelty causes desensitization and insist on heroic medical practices. The conclusion that complicates Halttunen's thesis comes in reconciling the qualitative difference between the masses observing public cruelty and the individual medical practitioner continually inducing and observing pain.

[43] See also Elizabeth B. Clark, "'the Sacred Rights of the Weak': Pain, Sympathy, and the Culture of Individual Rights in Antebellum America," *The Journal of American History* 82, no. 2 (1995):

surgical pain began to be viewed as a problem. As a cultural historian, Halttunen focuses on the emergence of a "culture of sensibility" as a precursor for the revolution in thinking about pain which foreshadowed anesthesia development. What distinguished the civilized from the savage was the civilized man's reluctance to inflict pain. From this emerged the pornography of pain, where pain was seen as titillating and obscene precisely because human sensibility rendered it unacceptable. Halttunen shows that the identification of pain as something negative, far from being inevitable, was primarily an emergent and contingent idea.

Literature on Entertainment, Culture, and Knowledge

As we shall see beginning in Chapter 3, nitrous oxide was a substance of public notoriety. Because the gas developed into a well-known substance in Nineteenth-Century American popular culture, it is important to understand the ways in which science, medicine, and technology were presented and performed before the American public. Much is written about the popularization of scientific ideas and scientific objects, however, the majority of the research focuses on England as the locale for the emergence of popular science.[44] Although it is clear from the literature that America and England

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463-493. Clark also does not discuss surgical pain, but the pain inflicted on slaves when they were tortured.

[44] Cf. Roger Cooter and Stephen Pumfrey, "Separate Spheres and Public Places: Reflections on the History of Science Popularization and Science in Popular Culture," *History of Science* 32 (1994): 237-267, Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820.* (Cambridge: Cambridge University Press, 1992), David M. Knight, "Communicating Chemistry. The Frontier between Popular Books and Textbooks in Britain

could not be considered culturally equivalent during the Nineteenth-Century, these explorations are useful as examples of what historians might do with newly discovered American sources. Cultural histories inform this project by generating new avenues of research into what has in the past been understood only in terms of the medical or the scientific. In order to reconstruct what was known about the substance nitrous oxide, it is essential that we look at all the contexts in which it was used. Nitrous oxide exhibitions were a popular form of public entertainment, and we need to review these instances of public knowledge generation in order to understand how nitrous oxide was understood in the wider context Nineteenth-Century America.

Ellen Hickey Grayson wrote one of the most informative and original articles on nitrous oxide exhibitions. Grayson's "Social Order and Psychological Disorder: Laughing Gas Demonstrations, 1800-1850," is an analysis structured on the idea of "interpretive frameworks," a theoretical construct usually applied to literature in order to

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During the First Half of the Nineteenth Century," in *Communicating Chemistry: Textbooks and Their Audiences 1789-1939*, ed. Anders Lundgren and Bernadette Bensaude-Vincent (Canton, MA: Science History Publications, 2000), John Money, "Joseph Priestley in Cultural Context: Philosophic Spectacle, Popular Belief, and Popular Politics in 18th-Century Birmingham," *Enlightenment and Dissent* 7 & 8 (1988 & 1989): 57-81 & 69-89, Simon Schaffer, "Natural Philosophy and Public Spectacle in the 18th Century," *History of Science* 21 (1983): 1-43, Steven Shapin, "Science and the Public," in *Companion to the History of Modern Science*, ed. Olby et. al. (1990), 990-1007.

gauge the reader's responses to a given literary work.[45] Grayson argues that as well as responses to literature, interpretive frameworks can also be employed while analyzing audience reactions to public spectacles. Her primary thesis is that nitrous oxide exhibitions reinforced, much like phrenology, the prevailing cultural standards concerning the relationship between the external indications of character and the internal true moral character of an individual. As Karen Halttunen has discussed at length in her book *Confidence Men and Painted Women*, during the Nineteenth-Century people were finding it progressively more difficult to sort out appearance from reality.[46] These nitrous oxide exhibitions served partially as a fulcrum for the reinforcement of cultural stereotypes as well as opening up the possibility of glimpsing onto the hidden character of those who appear to be gentlemen or ladies, but are nothing more than charlatans.

Nitrous oxide was exhibited at a number of dime museums during the early Nineteenth-Century.[47] Dime museums were specifically designed to provide moral entertainment and make 'useful knowledge' available to their patrons, while

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[45] Ellen Hickey Grayson, "Social Order and Psychological Disorder: Laughing Gas Demonstrations, 1800-1850," in *Freakery: Cultural Spectacles of the Extraordinary Body*, ed. Rosemarie Garland Thomson (New York: NYU Press, 1996), 108.

[46] Karen Halttunen, *Confidence Men and Painted Women: A Study of Middle-Class Culture in America, 1830-1870* (New Haven, CT: Yale University Press, 1982).

[47] Cf. Andrea Stulman Dennett, *Weird and Wonderful: The Dime Museum in America* (New York: New York University Press, 1997), Jack Rohan, *Yankee Arms Maker: The Incredible Career of Samuel Colt* (New York: Harper & Brothers, 1935).

simultaneously titillating and amusing.[48] Andrea Stulman Dennett's work on dime museums offers a detailed narrative chronicling the types of entertainments offered by these new museums to an eager and heterogeneous public. Dennett examines an institution that combined a thirst for 'useful knowledge' with amusements and entertainment. Her work exemplifies how scientific novelties and entertainment were integrated throughout Nineteenth-Century America through cheap public experiences that Americans of all social strata could afford.

Public lectures were a popular form of entertainment during the Nineteenth-Century, and often these lectures focused on scientific novelties, such as the phenomena of the newly developed chemistry. David Lindsay's work *Madness in the Making: The Triumphant Rise and Untimely Fall of America's Show Inventors* uniquely examines the integrated world of science, technology, and entertainment.[49] Lindsay utilizes resources which until recently have often overlooked by many historians, such as art, waxworks, and technology exhibitions and fairs. His history of what he terms "show-inventers" during the Nineteenth-Century is the only resource of its kind, in that Lindsay combines aspects of entertainment, popular culture, economics, and technology to portray a neglected aspect of American culture. Lindsay identifies a trend which emerged in the Nineteenth-

[48] "Useful Knowledge" was knowledge that contributed to the reinforcement of character and the accumulation of information. It was, on my interpretation, the intellectual corollary of the cabinet of curiosities, or the collection of natural history objects. Cf. William T. Alderson et al., eds., *Mermaids, Mummies, and Mastodons: The Emergence of the American Museum.* (Washington, D.C.: American Association of Museums, 1992).

[49] David Lindsay, *Madness in the Making: The Triumphant Rise and Untimely Fall of America's Show Inventors* (New York: Kodansha International, 1997).

Century, one he calls the "technological spectacle." These spectacles presented a new device or object so that it fit into a network of preexisting concepts. Lindsay traces the lineage of these Nineteenth-Century performers to the Eighteenth-Century mountebanks ("bench mounters") emerging out of the iterant entertainment tradition. In doing so Lindsay demonstrates that public consumption of novelties was not categorized based on intellectual prestige or legitimacy, but fell under a general rubric of consumable entertainment. Donald Scott, in his analysis of the role that lectures played in unifying the American public, takes the opposite stance.[50] Scott quickly dismisses the itinerant lecturers as insignificant, glorified mountebanks and con-artists. His interpretation betrays a certain bias against popular culture that prevents Scott from assessing all types of knowledge exchange and public enrichment, including show inventors exhibits, dime museums, and scientific demonstrations. In this thesis, I take the stance that it is important to take into consideration all instances of public knowledge regarding nitrous oxide and ether, not just those which through the lens of historians' categories are traditionally deemed to be legitimate.

Philosophical and Sociological applications

Part of the novelty of this project emerges from the application of philosophical and sociological frameworks to the instances of these early anesthesia demonstrations and nitrous oxide exhibitions. Here I review a few ideas borrowed from the Sociology of

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[50] Donald M. Scott, "The Popular Lecture and the Creation of a Public in Mid-Nineteenth-Century America," *Journal of American History* 66, no. 4 (1980): 791-809.

Scientific Knowledge (SSK) and conclude by discussing the philosophical necessity of integrating social and material inspired historical explanations, taking as my example the work of Bruno Latour.

Steven Shapin's *Social History of Truth* and Jan Golinski's *Science as Public Culture* are just two examples of historical projects which utilize sociological methods.[51] It is only in the past few years that some of the innovative approaches that emerged from contemporary studies of SSK have been legitimately applied to historical case studies, in contrast with the unresolved contemporary controversies that sociologists prefer to examine.[52] Shapin's sociological sympathies makes him one of the best contemporary historians of science.[53] In his article "Science and the public," Shapin examines the

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[51] Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820.* (Cambridge: Cambridge University Press, 1992), Steven Shapin, *The Social History of Truth: Civility and Science in Seventeenth-Century England* (Chicago: University of Chicago Press, 1994).

[52] H. M. Collins, "The Sociology of Scientific Knowledge: Studies of Contemporary Science.," *Annual Review of Sociology* 9 (1983): 272, Steven Shapin, "Here and Everywhere: Sociology of Scientific Knowledge," *Annual Review of Sociology* 21 (1995): 291. Cf. Peter Robert Dear, *Discipline and Experience: The Mathematical Way in the Scientific Revolution* (Chicago: University of Chicago Press, 1995).

[53] Cf. Steven Shapin, "Descartes the Doctor: Rationalism and Its Therapies," *British Journal for the History of Science* 33, no. 116 (2000): 131-154, Steven Shapin, "The House of Experiment in 17th-Century England," *Isis* 79, no. 298 (1988): 373-404, Steven Shapin, *The Social History of Truth: Civility and Science in Seventeenth-Century England* (Chicago: University of Chicago Press, 1994), Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton, N.J.: Princeton University Press, 1985).

historical construction of the categories "the public" and "science".[54] Shapin concludes that there has been a transfer of power and control over knowledge during the Twentieth-Century, from the public dictating what was important and worthy of scientific study to scientists who study public life, in the process determine what is important about public social life. Shapin concludes after examining aspects of the historical construction and emergence of these disparate categories, that the contents of "science" and "the public" are subject to temporal fluctuations, constantly being re-defined, re-invented and subverted. Shapin's work is pertinent to this project because he emphasizes that it is a historical error to delineate science and society as static and stable categories. Rather, we must understand how that which is understood historically as scientific and that which is understood historically as purely social or cultural are the artifacts of historians themselves. This project emphasizes the importance of interweaving so-called scientific and cultural contexts in order to understand the varied use of nitrous oxide throughout the Nineteenth-Century and the consequent emergence of inhalation anesthesia as a medical technology.

Theoretical underdetermination has been a problem that philosophers of science have debated throughout the twentieth century.[55] Whereas philosophers of science have

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[54] Steven Shapin, "Science and the Public," in *Companion to the History of Modern Science*, ed. Olby et. al. (1990), 990-1007.

[55] Cf. Pierre Duhem, *The Aim and Structure of Physical Theory*, trans. Philip P. Wiener (Princeton, NJ: Princeton University Press, 1954), 180-195, 210-218, W. V. O. Quine, "Two Dogmas of Empiricism," *Philosophical Review* 60 (1951): 98-116. Against the ubiquity of underdeterminism, cf. Larry Lauden, "Demystifying Underdeterminism," in *Scientific Theories*,

explored how theories cannot be supported conclusively by evidence, sociologists of science have introduced the idea, based on contemporary case studies, that what constitutes a positive experimental result is underdetermined prior to experimentation. In other words, until the experiments are actually performed, one cannot say what constitutes a correct or incorrect result. Sociologist Harry Collins formulates this idea into what he calls the "Experimenter's Regress." According to Collins, what makes an experiment a success or a failure is often not physically predetermined and contextually contingent. Collins argues that because the status of a result is socially negotiated, experiments are impossible to categorize as right or wrong by any objective standards in their earliest instances.[56] Applying Collins' ideas to the subject of this thesis, I categorize Wells' and Morton's so-called demonstrations as experiments, and then examine how their results were negotiated by those individuals who were present, emphasizing the social aspects of experimentation.[57]

One of the problems with applying SSK methodologies to the history of science and medicine is that a primary assumption of these techniques is that social causes take

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ed. C. Wade Savage, *Minnesota Studies in the Philosophy of Science* (Minneapolis: University of Minnesota Press, 1990), 267-297.

[56] H. M. Collins, *Changing Order: Replication and Induction in Scientific Practice* (Chicago: University of Chicago Press, 1992).

[57] It is interesting to note that Wells' and Morton's events in Boston are categorized as "demonstrations" in the historical literature, but by their contemporaries as "experiments."

precedence over causes dictated by the natural world.[58] Ian Hacking unpacks some of the assumptions surrounding ideas about social construction in his *The Social Construction of What*, clarifying what it means to talk about social construction, and the ramifications of claiming that knowledge and even physical objects are socially constructed.[59] Although looking at his topic in the context of the 'Science Wars', Hacking presented a sympathetic but generally very analytically biased view of social construction.[60] He is right to point out that that all historical causes cannot be reduced to social causes. The problem with Hacking's work is that although he admits for the possibility of social influences on knowledge and ideas, therefore admitting a trivial type of social construction, he ultimately relies on the natural world as unyielding arbiter of what is given in experience. In doing so, he effectively denies social construction in any non-trivial sense and reduces all vital instances of causation back to the "natural" (non-social) physical world. The problem with this interpretation is that it assumes the givenness of physical objects and dismisses the possibility that their relationship with individuals and institutions affects what they are. In the case of anesthetic substances, we need to understand both what

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[58] Cf. David Bloor, *Knowledge and Social Imagery*, 2nd ed. (Chicago: University of Chicago Press, 1991). H. M. Collins, "The Experimenter's Regress as Philosophical Sociology," *Studies in History and Philosophy of Science* 33 (2002): 153-160.

[59] Ian Hacking, *The Social Construction of What?* (Cambridge, MA: Harvard University Press, 1999).

[60] For information on the 'Science wars' cf. Jean Bricmont and Alan Sokal, *Inpostures Intellectuelles* (Paris: Odile Jacob, 1997), Alan Sokal, "A Physicist Experiments with Cultural Studies," *Lingua Franca*, no. May-June (1996): 61-64, Steven Weinberg, "Sokal's Hoax," *New York Review of Books* August 8, 1996, 11-15.

Hacking would characterize as the social and natural causes of its production and use during its developmental years. Just as any cause cannot, as SSK proponents believe, be reduced to the social, it cannot be reduced to the natural either.

The work of Bruno Latour leads us in a direction of compromise between the dichotomy of the social and natural.[61] He has stressed that this dichotomy is what needs to be philosophically reintegrated in order to understand the production of scientific knowledge and technology. Latour traces the split between the social and natural to the work of Immanuel Kant, and defines his program as an attempt to reintegrate these two polar opposites through the use of additional variables: stabilization and historicity.[62]

Latour's most well-known example of this type of integration is his historical work on Louis Pasteur and ferment. Just as historians might construct a narrative about Pasteur, emphasizing how the social and material aspects of his life and work are collected and collated to construct a historical narrative, Latour believes that the same sort of historicity can be applied to scientific objects themselves, in this case, the microbes

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[61] Cf. Bruno Latour, "The Force and Reason of Experiment," in *Experimental Inquiries*, ed. H. E. Le Grand (Dordrecht, Netherlands: Kluwer Academic Publishers, 1990), 49-80, Bruno Latour, "On the Partial Existence of Existing and Nonexisting Objects," in *Biographies of Scientific Objects*, ed. Loraine Daston (Chicago: University of Chicago Press, 2000), 247-269, Bruno Latour, "One More Turn after the Social Turn...," in *The Science Studies Reader*, ed. Mario Biagioli (New York: Routledge, 1999), 276-301, Bruno Latour, *Pandora's Hope: Essays on the Reality of Science Studies* (Cambridge, MA: Harvard University Press, 1999), Bruno Latour, *Pasteurization of France* (Cambridge, MA: Harvard University Press, 1988).

[62] Bruno Latour, "One More Turn after the Social Turn...," in *The Science Studies Reader*, ed. Mario Biagioli (New York: Routledge, 1999), 286.

that Pasteur worked with.[63] Latour emphasizes that experiment is dynamic, with the end results being greater than all the disparate inputs.

> No event can be accounted for by listing the elements that enter the situation *before* Pasteur launched his experiment, *before* the yeast started to eat up the right handed tartrate, *before* the meeting of the Academy. If such a list were made, the actors would *not* be endowed with the competence that they *acquire* in the event: Pasteur is a promising crystallographer but he has not shown to anyone's satisfaction that the ferments were living creatures; the yeast may accompany the fermentation, as Liebig claimed, but is not yet endowed with the property of selecting out left- from right-handed crystals; as for the Academicians they do not depend on a living yeast in their own laboratories but prefer to remain on the solid ground of chemistry. The list of inputs does not have to be completed by drawing upon any stock resource, since the one drawn upon *before* the experimental event is not the same as the one drawn upon *after*.[64]

This lengthy quote makes several important points. First of all, like Collins, Latour emphasizes that experiments are not complete and results cannot be simply derived from the assemblage of social and material factors put in. For Latour, experiments are not a zero-sum game; they are events which integrate social and material components, resulting in a sum that is greater than the combination of its parts. Another point is that Latour prioritizes neither social nor material causes when describing the results of an experimental event. In this sense he maintains a type of causal symmetry that sociologists,

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[63] Bruno Latour, *Pasteurization of France* (Cambridge, MA: Harvard University Press, 1988), 13-110.

[64] Bruno Latour, "The Force and Reason of Experiment," in *Experimental Inquiries*, ed. H. E. Le Grand (Dordrecht, Netherlands: Kluwer Academic Publishers, 1990), 65. Emphasis in original.

who reduce all causes to social causes, and philosophers, who reduce all causes to material causes, are unable to maintain.[65] Finally, by his example, Latour emphasizes the necessity of emphasizing the local nature of scientific work. The spatiotemporal location of experiment is something that can be empirically studied, and often reveals the uniqueness of a particular scientific activity.

As we have seen, many of the standard historical treatments of anesthesia have assumed that anesthesia is something that was discovered at some point in time, having existed in nature like a ripe fruit ready to be picked and consumed. Nitrous oxide is understood similarly, with historians asking why it was not brought into extensive use as an anesthetic until the 1860s. This thesis takes an opposing stance, uncovering the multilayered history of this substance and implicitly inquiring instead, considering its usage in context, why *would* the gas be used as an anesthetic? By remaining faithful to the social and material contexts in which the gas was used, and by understanding how knowledge about the gas was perpetuated, I show that when nitrous oxide remains thoroughly contextualized, the unique historicity of this substance explains why the gas was not characterized as an anesthetic until late in the Nineteenth-Century.

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[65] For sociology, cf. David Bloor, *Knowledge and Social Imagery*, 2nd ed. (Chicago: University of Chicago Press, 1991). Bloor always prioritizes the social in his explanatory structure. For philosophy, cf. Larry Lauden, *Beyond Positivism and Relativism: Theory, Method and Evidence* (Boulder, CO: Westview, 1996). As a realist, Lauden believes that causes can be reduced to the natural world.

What lies ahead: the novelty of this project

As I have shown from a review of the pertinent literature, explanations for Wells' initial failure and Morton's near instant success are incomplete at best. In order to rectify this oversight, a new type of historiographical analysis is in order. Missing from the literature is a history of nitrous oxide itself. We have narratives about the people responsible for using the gas, as well as narratives about the technology involved in producing the gas.[66] While both of these are essential to understanding the adoption of anesthetic substances, I intend to focus on the nitrous oxide and how both the people and technology surrounding it worked to produce knowledge and change practice. In the same sense that Bruno Latour focused on the reciprocal developments of the historical figure Louis Pasteur and the ferment he worked upon, I shall trace nitrous oxide itself within the historical context of its emergence. Thus, analogous to a historical figure, nitrous oxide gas will become the key character in our historical narrative, allowing us to understand how it was used and how knowledge about the gas developed. The result is a

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[66] For histories of the people involved, cf. W. Harry Archer, *Chronological History of Horace Wells, Discoverer of Anesthesia* ([n.p.,: 1939), David A. Chernin, ""Genius, the Result of Original Mental Superiority:" John M. Riggs and Horace Wells.," in *I Awaken to Glory: Essays Celebrating Horace Wells*, ed. Richard J. & Menczer Wolfe, Leonard F. (Boston: Boston Medical Library, 1994), 255-274, Richard J. Wolfe, *Tarnished Idol: William Thomas Green Morton and the Introduction of Surgical Anesthesia : A Chronicle of the Ether Controversy* (San Anselmo, CA: Norman Publications, 2001). For the technology of anesthetics, cf. W. D. A. Smith, *Under the Influence: A History of Nitrous Oxide and Oxygen Anaesthesia* (London: Macmillan Publishers, 1982), 123-154, Kenneth Bryn Thomas, ed., *The Development of Anaesthetic Apparatus: A History Based on the Charles King Collection of the Association of Anaesthetists of Great Britain and Ireland* (Oxford: Blackwell Scientific, 1975).

rich understanding of the contextualized substance nitrous oxide resulting from complex and interdisciplinary historical narrative.

Following this literature review, Chapters 2-5 comprise the historical narrative and analysis and are designed to reconstruct ideas about nitrous oxide in order to show its unique historicity. Chapter 2 is an overview of the birth and infancy of nitrous oxide. This chapter outlines the first isolations of nitrous oxide, the purification processes, and the long lasting practical ramifications of its early experimentation and usage in Britain. Closely tracing nitrous oxide during its formative years shows how its early use in Bristol and London determined how it was later used in America, undertaken through a textual analysis of the early published materials on nitrous oxide. I trace the gas from its early inceptions by Joseph Priestley through its use by Humphry Davy to its importations into America. Though an analysis of the early experiments with the gas, I conclude that research on nitrous oxide seemed to taper off and fall out of favor at the beginning of the Nineteenth-Century due primarily to its recreational uses.

Chapter 3 continues the narrative, but with a shift in methodology. After the first decade of the Nineteenth-Century, even though nitrous oxide fell out of favor with scientists and physicians, it did not disappear entirely from view. Public lectures and exhibitions of nitrous oxide for entertainment purposes in America brought the gas into a wider cultural milieu. In this chapter I explore these exhibitions through broadsides, newspaper advertisements and published reviews of these popular events. I argue that nitrous oxide demonstrations functioned to establish and reinforce social standards, as well as serving as a way to identify aspects of an individual's character during a time when

outward manifestations of inner motives became less definitive. In other words, nitrous oxide took on cultural currency as an object providing both popular public entertainment and private knowledge of the individual that might otherwise be difficult or impossible to obtain in rapidly shifting antebellum society.

Chapter 4 looks at how science and entertainment were linked in Horace Wells nitrous oxide demonstration at Massachusetts General Hospital, and then were separated by William Morton's ether demonstration. I examine recollections and first hand accounts from witnesses of these events, explaining how the physical locations of these experiments and the attitudes of their audiences were integral in the denigration of Wells and elevation of Morton.

Chapter 5 completes the circuitous route that nitrous oxide took by showing how the gas shifted from an catalyst of amusement to a tool of dental practice. Nitrous oxide was used primarily for entertainment purposes until the liminal figure Gardner Quincy Colton was able to bring nitrous oxide anesthesia into dentistry. We find that although Colton played a key role in Wells nitrous oxide use, he additionally was responsible for the extensive use of the gas as both a socially significant toy and an anesthetic. His promotion of laughing gas as a tool in reinforcing and constructing class boundaries in the 1860s and 1870s assured its popularity with the middle class. Yet Colton's pragmatic and relentless campaigning in favor of using the gas as an inhalation anesthetic led directly to the adoption of nitrous oxide into dental practice.

Chapter 6 answers the historical question: why Horace Wells' demonstration of nitrous oxide as a surgical painkiller failed, while Morton's ether demonstration just two

years later succeeded? I offer three explanations. The first is that while Wells and Morton's events are both considered by historians to be demonstrations, both functioned more as experiments. While in Wells case, this experimental uncertainty served to undermine his credibility, Morton was successful at negotiating an authoritative stance and thus was perceived as an expert in his area. Second, if we understand these demonstrations functioned more as experiments, the openness and undefined nature of Wells and Morton's demonstrations becomes clear. Third, we can examine how contingent local factors (physical location, technology, and terminology) each affected the outcome of these events.

Chapter 7 sums up the arguments of the previous chapters, emphasizing that the interdisciplinary methodology employed throughout this thesis can be used as a template for further research into objects and ideas found in what have traditionally been separate disciplines within the large confines of historical research. My final hope is that this thesis can serve as an example of the new interpretations possible by mining primary resources and contemporary methodologies from our sister Humanities.

Chapter 2. The birth of nitrous oxide

In chronicling the history of the substance that eventually became understood as nitrous oxide anesthesia, I am able to account for why nitrous oxide gas fell out of favor as an object of scientific inquiry during the first decade of the Nineteenth-Century despite the overall burgeoning interest in gases and chemistry. After Joseph Priestley noticed what he called "dephlogisticated nitrous air," in the 1770s, this substance was overshadowed in Europe by interest in "dephlogisticated air" or oxygen. American Samuel Latham Mitchill revived interest in nitrous oxide gas in the 1790s when he categorized it as toxic, the cause of fevers and plague. Humphry Davy, working with Thomas Beddoes on pneumatic medicine at Bristol, England's Pneumatic Institution, refuted Mitchill by proving that the gas was respirable and experimented extensively with the nitrous oxide, both privately and publicly later at the Royal Institution. In the United States during the first decade of the Nineteenth-Century, James Woodhouse and William Barton worked to corroborate Davy's findings, despite overwhelming skepticism from their scientific peers.

Nitrous oxide, however, turned out to be the disappointing child of chemistry; the bad seed of the factitious airs. Rather than being a dependable substance that could be counted on for consistent results, nitrous oxide was itself married to unpredictability. When this unpredictability became publicly manifest in satirical cartoons and poems about nitrous oxide experimentation at the turn of the Nineteenth-Century, experimenters were quick to dismiss the

gas and its frivolous associations. By the first decade of the Nineteenth-Century, the gas fell into disrepute in professional circles and was dismissed by chemists and physicians as nothing more than a novelty.

Nitrous Air and Diminished Nitrous Air

The first experiments leading to the isolation of nitrous oxide were performed by Joseph Priestley (1733-1804) beginning on 4 June 1772 at his laboratory in Leeds. He attempted to re-create the "turbid red mixture" that partially absorbed common air referred to in Stephen Hales' *Vegetable Staticks* (1727) by combining common air and the spirit of nitre (nitric acid).[67] It was the creation of this red substance that was Priestley's original intention: he attempted at replicate an aesthetically pleasing and novel phenomenon.[68] The red gaseous mixture was achieved by combining metal with spirit of nitre over heat. After a discussion with Henry Cavendish in London during the spring of 1772 Priestley remembered,

> I began with the solution of the different metals in the spirit of nitre, and catching the air which was generated in the solution, I presently found what I wanted, and a good deal more.[69]

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[67] Stephen Hales, *Vegetable Staticks: Or, an Account of Some Statical Experiments on the Sap in Vegetables: Being an Essay Towards a Natural History of Vegetation. Also, a Specimen of an Attempt to Analyse the Air, by a Great Variety of Chymio-Statical Experiments.* (London: W. & J. Innys and T Woodward, 1727). For information on Hales equipment, cf. J. Parascandola and A.J. Ihde, "History of the Pneumatic Trough," *Isis* 60 (1969): 351-361.

[68] For the aesthetics of experiment, cf. Alexander Rueger, "Aesthetic Appreciation of Experiments: The Case of 18th-Century Mimetic Experiments," *International Studies in the Philosophy of Science* 16, no. 1 (2002): 49-59.

[69] Joseph Priestley, "Observations on Different Kinds of Air," *Philosophical Transactions of the Royal Society* 62 (1772): 210.

Cavendish suggested that the key component in producing this red mixture was spirit of nitre. Pyrites (iron sulfide) was one necessary ingredient in the production of the red cloud phenomenon, but Cavendish believed that nearly any crystallized metal would give the desired results. He told Priestley that the spirit of nitre was the essential ingredient in producing the red cloud. Priestley followed Cavendish's advice and substituted bits of brass for the pyrites when he found that pyrites were becoming prohibitively expensive. After combining his ingredients and creating his turbid red phenomenon, Priestley found that a clear air emerged as a side effect of the interaction, an air that Hales had neglected to name. Priestley named this air *nitrous air* because the ingredient essential to its production seemed to be the spirit of nitre.

Priestley quickly became fascinated with his nitrous air. He combined it with common air and was astonished to find that the result was a diminished volume of both common air and nitrous air, in unequal proportions. The common air was reduced in volume far more than the nitrous air, reduced to approximately one-ninth the combined measure of the original two airs. This was shocking, for it seemed as if one air was "devouring" another, with the combined outcome smaller than either measures of the two original airs:

> I hardly know any experiment that is more adapted to amaze and surprise than this is, which exhibits a quantity of air, which, as it were, devours a quantity of another kind of air half as large as itself, and yet is so far from gaining any addition to its bulk, that it is diminished by it.[70]

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[70] Joseph Priestley, "Observations on Different Kinds of Air," *Philosophical Transactions of the Royal Society* 62 (1772): 212.

Priestley found that the appearance of the turbid red mixture and the consequent overall reduction in volume of air was particular to the combination of nitrous air with common air (air fit for respiration). Contaminated common air (air unfit for respiration) did not produce the same effects. Priestley was quick to note the potential application of this drastic reduction in volume in identifying toxic air. For if a measure of nitrous air was combined with a measure of common air, the volume of the combination would prove whether or not the air was fit for respiration.[71]

This discovery greatly affected the practice of chemistry . As a profoundly spiritual man, Priestley was always uncomfortable with the existing test for good air: placing a mouse in an air-tight container with the air in question. If the mouse survived a few minutes confinement, the air was deemed respirable. If not, the air was deemed toxic. Priestley, having been deeply disturbed by deaths of so many small creatures at the hands of chemists, suggested that these quantitative volume tests could replace using live mice when testing for respirable air. His suggestions resulting in the emergence of a new subcategory of chemical inquiry: eudiometry.

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[71] Joseph Priestley, "Observations on Different Kinds of Air," *Philosophical Transactions of the Royal Society* 62 (1772): 214.

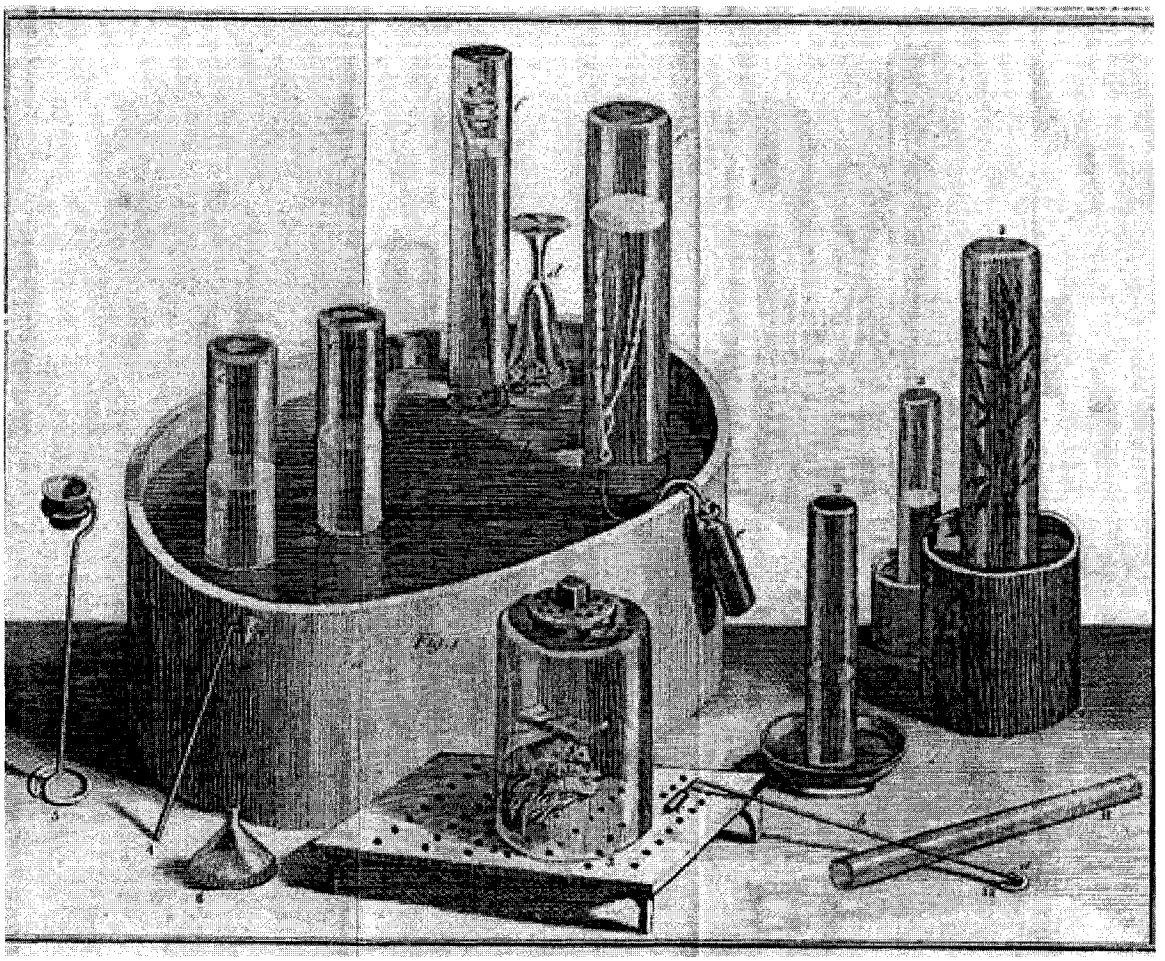

Figure 1. Priestley's equipment for determining the "goodness" of air. Changes in volumes were indicated by changes in water levels. Notice the mouse inside the glass jar in the foreground, the old "test" for respirable air.[72] Quantitative changes in the gas volume due to chemical reactions, especially those changes that could determine the "goodness" of air, soon became a study in its own right named eudiometry.[73]

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[72] Joseph Priestley, *Experiments and Observations on Different Kinds of Air* (London: J. Johnson, 1774), 1-2. For more information about this apparatus cf. Lawrence Badash, "Joseph Priestley's Apparatus for Pneumatic Chemistry," *Journal of the History of Medicine* 19, no. 139-155 (1964): 139-155.

[73] For a history of eudiometry apparatus cf. Trevor H. Levere, "Measuring Gases and Measuring Goodness," in *Instruments and Experimentation in the History of Chemistry*, ed. Frederic Lawrence Holmes and Trevor H. Levere (Cambridge, MA: MIT Press, 2000), 105-135. For advances in eudiometry apparatus cf. Henry Cavendish, "An Account of a New Eudiometer.," *Philosophy* 73 (1783): 106-135,

The production of these diminishing measures of common air led Priestley to note that nitrous air produced by the reaction itself was susceptible to a similar sort of reduction in volume which had produced the nitrous air in the first instance. After making a paste of iron filings and brimstone, Priestley found that mixing this paste with nitrous air over heat produced an astonishing reduction: less than one-fourth of the original measure remained, and it could be reduced no further. Priestley referred to this substance *diminished nitrous air.* He noted that the diminished nitrous air was somewhat different in character from the original nitrous air. It did not have the typical foul smell of nitrous air, and it supported combustion. However, even though this further diminished nitrous air exhibited different characteristics from regular nitrous air, Priestley did not consider this air in any fundamental way different from nitrous air. When he published his findings on factitious, or man-made airs in the *Philosophical Transactions of the Royal Society* in 1772, he included his experiments for obtaining diminished nitrous air, but did not categorize the resulting air as a separate new breed of factitious air.[74]

In 1774, Priestley published an extensive volume covering his research on airs, *Experiments and Observations on Different Kinds of Air.*[75] In this work he detailed the properties and uses of nitrous air that he had outlined in his earlier article. Priestley presented the idea that nitrous air was a natural occurring substance, the result of the decomposition of

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William H. Pepys, "A New Eudiometer, Accompanied with Experiments, Elucidating Its Application," *Philosophical Transactions of the Royal Society* 97 (1807): 247-259.

[74] Joseph Priestley, "Observations on Different Kinds of Air," *Philosophical Transactions of the Royal Society* 62 (1772): 210-224.

[75] Joseph Priestley, *Experiments and Observations on Different Kinds of Air* (London: J. Johnson, 1774).

atmospheric air. As we shall see in the next section, this particular idea would become very important in grounding the theories of American physician Samuel Latham Mitchill.

Most important for our purposes is the comparative experiment that Priestley performed on iron. He decided that he wanted to compare the air resulting from exposing fixed air to iron for an extended period of time, with the result of exposing nitrous air to iron for the same duration. The results obtained by experimentation using fixed air were uninteresting, but again Priestley found that the strange species of diminished nitrous air appeared when ordinary nitrous air was left exposed to iron. This new air had properties unlike the other airs that Priestley had encountered.

> In these circumstances the two phials stood about two months, when no sensible change at all was produced in the fixed air, or in the iron which had been exposed to it, but a most remarkable, and most unexpected change was made in the nitrous air; and in pursuing the experiment, it was transformed into a species of air, with properties which, at the time of my first publication on this subject, I should not hesitate to pronounce impossible, *viz.* air in which a candle burns quite naturally and freely, and which is yet in the highest degree noxious to animals, insomuch that they die the moment they are put into it; whereas, in general, animals live with little sensible inconvenience in air in which candles have burned out. Such, however, is nitrous air after it has been long exposed to a large surface of iron.[76]

Even though Priestley stated that this species of air had the contradictory properties of non-combustibility and toxicity to animals, a few pages later he modified his original conclusions about the air. He noted that if one continues to add more nitrous air to this species of air, that it

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[76] Joseph Priestley, *Experiments and Observations on Different Kinds of Air* (London: J. Johnson, 1774), 215.

continued its stunning transformation. Even though this air began as highly poisonous to animals, it eventually becomes respirable again.

> But this noxious quality, like the noxious quality of all other kinds of air that will bear agitation in water, is taken out by this operation [adding more nitrous air], continued about five minutes; in which process it suffers a further and very considerable diminution. It is then itself diminished by fresh nitrous air, and animals live in it very well, about as well as in air in which candles have burned out.[77]

We can see that by 1774 Priestley had clearly noticed that ordinary nitrous air and the product of multiple diminutions of nitrous air were two different substances. However, he did not yet distinguish this diminished air as a different species of air. He continued working with nitrous air, and began to realize that it potentially yielded a number of interesting varieties. In a 1775 article discussing three types of acid airs, he singled out the nitrous acid as the most interesting and experimentally fruitful.

> The more I consider the nitrous acid, the more wonderful and inexhaustible the subject appears. The kinds of air which it forms, according to its various combinations with *phlogiston*, are, I believe, more numerous than all the kinds that can be formed by the other acids.[78]

By 1786, Priestley was able to distinguish in print between nitrous air and diminished nitrous air. He found its unusual properties helpful in contrasting this diminished air with common nitrous air. Priestley called his new air *dephlogisticated nitrous air.*

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[77] Joseph Priestley, *Experiments and Observations on Different Kinds of Air* (London: J. Johnson, 1774), 217.

[78] Joseph Priestley, "An Account of Further Discoveries in Air," *Philosophical Transactions of the Royal Society* 65 (1775): 386.

> Dephlogisticated nitrous air is the term by which I first distinguished this species of air, because it admitted a candle to burn in it.[79]

In concert with the Phlogiston Theory that Priestley favored, he called this air dephlogisticated because it would allow for combustion. However, this dephlogisticated nitrous air would be pushed aside for several years while philosophers and practical chemists examined dephlogisticated common air, the substance Antoine Lavoisier came to term oxygen, and its role in respiration. Dephlogisticated nitrous air did not become a serious object of inquiry until the 1790s.

Priestley had claimed in *Philosophical Empiricism* that the "nature of the thing" is not affected by the choice of terminology.[80] Even if the choice of terminology does not affect the substance, we can see that in the case of distinguishing between nitrous air and dephlogisticated nitrous air, the act of naming the substance functions as a way of marking the air as a new subject for inquiry. This coining of new terminology allowed for changes in practice to be brought about that took into consideration the different properties of nitrous air and dephlogisticated nitrous air. In other words, dephlogisticated nitrous air was now understood as being a different substance than plain nitrous air, and could be examined in its own right. Nomenclature continued to be important in the history of dephlogisticated nitrous air, especially when Samuel Latham Mitchill (1764-1831) studied the varieties of nitric acid.

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[79] Joseph Priestley, *Experiments and Observations Relating to Various Branches of Natural Philosophy; with a Continuation of the Observations on Air*, vol. I (Birmingham: Pearson, 1786), 324.

[80] Joseph Priestley, *Philosophical Empiricism: Containing Remarks on a Charge of Plagiarism Respecting Doctor H–S.* (London: J. Johnson, 1775), 53-54.

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SAMUEL. L. MITCHILL. M.D. L.L.D.

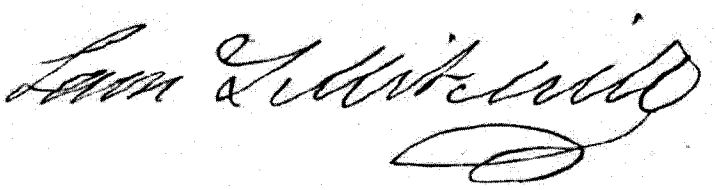

Figure 2 Samuel Latham Mitchill, father of the Doctrine of Septon. (Courtesy of the Dibner SIL digital library).

Joseph Priestley moved to the United States in 1794, settling in Northumberland, Pennsylvania outside of Philadelphia. Although he declined the offer of a Chair at the University of Pennsylvania's Chemistry Faculty, he became a member of the American Philosophical Association and initiated a lively debate in the pages of the *Medical Repository* concerning the anti-phlogiston movement in North America. The *Medical Repository* was the first American medical journal, and it was founded in part by Samuel Latham Mitchill, an American who had an interest in nitrous gases.[81]

Mitchill completed his medical education in Edinburgh in 1786, where he learned of pneumatic medicine from Joseph Black and saw many experiments with the new factitious airs. He returned to the United States in 1787 and was employed as lecturer in chemistry, natural philosophy and agriculture at Columbia College and at the College of Physicians and Surgeons in New York City. When Yellow Fever began to ravage the populations of American coastal cities in the early 1790s, Mitchill was eager to find some way of curtailing the epidemic.[82]

During the 1790s in America, outbreaks of Yellow Fever destroyed populations of urban areas such as Philadelphia, and Mitchill was one of many American physicians who attempted to

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[81] For information about the *Medical Repository*, cf. S. M. Edelstein, "The Chemical Revolution in America in the Pages of the "Medical Repository"." *Chyma* 5 (1959): 155-179, Richard J. Kahn and Patricia G. Kahn, "The Medical Repository - the First U.S. Medical Journal (1797-1824)," *New England Journal of Medicine* 337, no. 26 (1997): 1926-1930.

[82] For Mitchill's biography, cf. Norman A. Bergman, "Samuel Latham Mitchill (1764-1831). A Neglected American Pioneer of Anesthesia," *Journal of the American Medical Association* 253, no. 5 (1985): 675-678, Courtney Robert Hall, *A Scientist in the Early Republic: Samuel Latham Mitchill 1764-1831.* (New York: Columbia University Press, 1934).

formulate theories about the generation and spread of devastating disease. Mitchill published his ideas about contagious disease in *Remarks on Gaseous Oxyd of Azote* in 1795.[83] This text was appended to Thomas Beddoes and James Watt's publication of *Considerations on the Medicinal Powers and the Production of Factitious Airs* in Britain that same year.[84] For Mitchill, the key to many ills was nitric acid and its chemical relatives. Mitchill developed complex theories about what he called "gaseous oxyd of Septon" and its relation to disease. He attempted to modify French chemical nomenclature by constructing a new terminology set around nitric acid. Whereas the French by this time used the terms "nitrogene" or "azote," Mitchill suggested that these be replaced by the word *Septon,* taken from the Greek word "σεπτω" meaning "putrefy". All variations of nitric acid and nitric acid gas, such as nitrous oxide gas, were for Mitchill simply variations of Septon derived from decaying and putrefying animal matter. When the body was healthy, it easily expelled these gases. However, when the sick body could not void these noxious gases, they caused horrible effects upon the human constitution. Mitchill claimed that nitric acid was produced naturally in the excrement of animals, and that nitrous oxide was therefore found

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[83] Samuel Latham Mitchill, *Remarks on the Gaseous Oxyde of Azote, or of Nitrogene and on the Effects It Produces When Generated in the Stomach, Inhaled into the Lungs, and Applied to the Skin: Being an Attempt to Ascertain the True Nature of Contagion , and to Explain Thereupon the Phenomena of Fever.* (New York: T & J Swords, 1795).

[84] Thomas Beddoes and James Watt, *Considerations on the Medicinal Powers and the Production of Factitious Airs. Five Parts in One Volume.* (Bristol: Bulgin & Rosser, 1794-1796). Beddoes had been corresponding with Mitchill during the 1890s. cf. Norman A. Bergman, *The Genesis of Surgical Anesthesia* (Park Ridge, IL: Wood Library-Museum of Anesthesiology, 1998), 236.

in nature as a gas formed through decomposition.[85] The idea that decaying animal products were the basis of Septon is the key to making sense of Mitchill's work. His argument was based on the fact that he observed metal objects turning black when left exposed to the air in the room of one who was ill. Therefore, nitrous oxide was classified as a variation of the acid that corroded metal objects and, like other well known acids, destroyed human flesh Mitchill claimed that nitrous oxide differs from nitric acid only in the degree of oxygenation, and thus concluded that nitrous oxide gas, or gaseous oxyde of Septon as he termed it, was produced naturally from a variety of sources, such as rotting meat, wool, and decaying organic material.

> Where large masses of animal and vegetable matter, in hot seasons and confined places, undergo resolution into their constituent parts, and form new combinations; is it not presumable that gaseous oxyd may be extricated from familiar materials by like causes, occasionally, in the alimentary canal, or *primae viae* of human bodies when alive?[86]

Mitchill argued that gaseous oxyde of Septon, nitrous oxide, was formed naturally through the chemical reactions involving decomposing organic materials. This gas could be formed either outside the body or within the body. Consequently, either the inhalation of these airs or noxious gas production within the body produced plague-like illness.

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[85] Samuel Latham Mitchill, *Remarks on the Gaseous Oxyde of Azote, or of Nitrogene and on the Effects It Produces When Generated in the Stomach, Inhaled into the Lungs, and Applied to the Skin: Being an Attempt to Ascertain the True Nature of Contagion , and to Explain Thereupon the Phenomena of Fever.* (New York: T & J Swords, 1795), 12.

[86] Samuel Latham Mitchill, *Remarks on the Gaseous Oxyde of Azote, or of Nitrogene and on the Effects It Produces When Generated in the Stomach, Inhaled into the Lungs, and Applied to the Skin: Being an Attempt to Ascertain the True Nature of Contagion , and to Explain Thereupon the Phenomena of Fever.* (New York: T & J Swords, 1795), 15.

> The cause of plague, and consequently of other analogous fevers, would seem to reside then, in the animal part of the ingesta; and so, according to the theory, it ought; for, from that source should flow the azote, or base of the gaseous oxyd, the cause of the most alarming and dangerous symptoms accompanying this class of distempers.[87]

Mitchill's arguments in this text were Aristotelian: rhetorical and philosophical, not experimental. He quoted the ancient authorities in support of his conclusions, including Hippocrates, and reinterpreted these archaic reports of disease so that they fit neatly into his doctrine of Septon. In contrast with Priestley and the Dutch chemists that Mitchill claimed inspired his work, it appears that he never performed a single experiment testing his arguments. Because Mitchill emphasized cleanliness as a counter to disease, some of the local applications of his doctrine were successful in curtailing the spread of some fevers.[88] In an article published in 1797, Mitchill tempered his ideas, more specifically associating Septon with nitrous acid rather then nitrous oxide gas. Although a member of the Septon family of toxic chemicals, he deemed it possible that gaseous oxyde of Septon might not be as acidic as he had originally believed, and admitted a more agnostic stance on the toxicity of nitrous oxide.

> If the septous or azotic air, just mentioned, has dissolved a very small portion of oxygene, so as to oxydate, but not acidify it, a very

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[87] Samuel Latham Mitchill, *Remarks on the Gaseous Oxyde of Azote, or of Nitrogene and on the Effects It Produces When Generated in the Stomach, Inhaled into the Lungs, and Applied to the Skin: Being an Attempt to Ascertain the True Nature of Contagion , and to Explain Thereupon the Phenomena of Fever.* (New York: T & J Swords, 1795), 19.

[88] Norman A. Bergman, *The Genesis of Surgical Anesthesia* (Park Ridge, IL: Wood Library-Museum of Anesthesiology, 1998), 114.

> singular sort of gaseous compound is formed, whose operation, in agriculture, has never yet been properly investigated.[89]

Maintaining the overall thrust of his theory of Septon, Mitchill nevertheless mitigated his original conclusion that nitrous oxide was the key villain in the spread of fevers, choosing instead to back-peddle by emphasizing the role of acid more generally in disease generation.

Still, there were those critical of his assessment of air born contagion. In another 1797 article published in New York, Mitchill applied his doctrine of Septon to a variety of cities in America and Europe, theoretically explaining how the various forms of Septon interacted with local features, such as building materials and local plant life, to spread disease.[90] Dr. H. Clutterbuck responded to Mitchill's claims in a letter to the editor of *Philosophical Magazine*.[91] Clutterbuck observed that Lisbon, for example, was dense with noxious effluvia from the copious refuse left to rot in the streets. Yet Lisbon did not have a problem with contagious disease. Clutterbuck believed that buildings in Lisbon were constructed from a different type of stone than those in Philadelphia, a stone that could neutralize acids and render noxious fumes benign. He primarily criticized Mitchill for not taking into consideration the effect that the environment could have on noxious effluvia.

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[89] Samuel Latham Mitchill, "Remarks on Manures. Wherein by an Inquiry into the Nature of Septon, (Azote) and Its Relations to Other Bodies, It Will Be Seen How Nearly Physic and Farming Are Allied to Each Other," *Medical Repository* 1, no. 1 (1797): 35.

[90] Samuel Latham Mitchill, "Affinities and Relations of Septic (Nitric) or Pestilential Fluids to Other Bodies," *The New York Magazine, or Literary Repository* 2, no. 1 (1797): 11-15.

[91] H. Clutterbuck, "A Letter to the Editor, Containing Some Objections to the Mitchillian Theory of Pestilential Fluids," *Philosophical Magazine* 5 (1799): 188-190.

Mitchill's characterization of nitrous oxide as toxic served to stall research on the gas during the 1790s. Despite the fact that he performed no experiments, he published prolifically on the topic during these years, and was an avid letter writer.[92] Philosophers, physicians and chemists in both Britain and the United States read Mitchill's work and took his suggestions about contagion and nitrous oxide seriously.[93] One of these individuals was the young researcher Humphry Davy (1778-1829). Davy's work on nitrous oxide would forever change the use of the gas, and would determine its niche in American culture for the first half of the Nineteenth-Century.

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[92] Cf. Samuel Latham Mitchill, "Affinities and Relations of Septic (Nitric) or Pestilential Fluids to Other Bodies," *The New York Magazine, or Literary Repository* 2, no. 1 (1797): 9-17, Samuel Latham Mitchill, "Application of Mr. Mitchill's Doctrine of Pestilential Fluids to Establish a Theory of Hail.," *New York magazine of Literary Repository* New Series 1 (1796): 351-356, Samuel Latham Mitchill, "Concerning the Use of Alkaline Remedies in Fevers, and the Analogy between Septic Acid and Other Poisons; in a Letter to Thomas Percival, M. D. &C. Of Manchester, from Dr. Mitchill, Dated New-York, January 17, 1797," *Medical Repository* 1, no. 2 (1797): 265-277, Samuel Latham Mitchill, "The Doctrine of Septon; Attempted after the Manner of Dr. Darwin.," *Medical Repository* 1 (1797): 189-193, Samuel Latham Mitchill, "Effects of Pestilential Fluids (Combination of Septon and Oxygene) Upon the Sanguiferous System of Animals, Particularly the Human Species," *New York Magazine, or Literary Repository* 1, no. 10 (1796): 539-545, Samuel Latham Mitchill, "Further Facts Tending Towards an Explanation of the True Operation of Alkalis and Lime Upon Other Substances. In a Letter from Dr. Mitchill to Thomas Beddoes, M. D., Dated New-York, September 15, 1797," *Medical Repository* 1, no. 2 (1797): 185-193, Samuel Latham Mitchill, "Illustrations of Mr. Mitchill's Doctrine of the Operation of Pestilential Fluids Upon the Human Body," *Medical Repository* 1, no. 8 (1796): 419-423.

[93] Cf. Erasmus Darwin, *Phytologia; or the Philosophy of Agriculture and Gardening* (London: J. Johnson, 1800), 260, Robert Hamilton, *Remarks on Hydrophobia or the Disease Produced by the Bite of a Mad Dog or Other Rabid Animal*, 2 vols. (London: Longman, 1798), 169, James Tytler, *A Treatise on the Plague and Yellow Fever* (Salem, MA: Joshua Cushing for B.B. Macanulty, 1799).

Nitrous oxide

In 1798, Mitchill published a notice in the *Medical Repository* about the experiments taking place at Thomas Beddoes' Pneumatic Institution in Bristol. He referred to the utility of the latest edition of Beddoes and Watt's *Considerations on the Medicinal Use and Production of Factitious Airs*, commenting that physicians especially would find the text useful.

> This valuable work abounds with the most interesting information to mankind in general, as well as to physicians in particular, whom it seems to arm with new weapons wherewith to encounter disease. Experiments already made sufficiently attest to the great power and efficacy of various Factitious Airs in the cure and alleviation of different diseases; and we are led to believe, that the Pneumatic Institution, under the direction of Dr. Beddoes, will not fail to determine, with scrupulous accuracy, the peculiar situations to which each species of Air may be most successfully applied.[94]

Mitchill seemed hopeful about the future of pneumatic medicine in the hands of Beddoes. But Beddoes himself did not engage in a great deal of experimentation with the factitious airs; that was left to his superintendent, Humphrey Davy. Davy, a bright but completely unknown experimenter, had joined Beddoes at the Pneumatic Institution in October 1798 at the suggestion of Davies Giddy.

In March of 1798, Davy began to study dephlogisticated nitrous air. He was intrigued by Mitchill's doctrine of Septon, as reprinted as the appendix to Beddoes and Watts' text on factitious airs, a book Davy was supposedly exposed to by his friend Giddy.[95] Davy especially objected to Mitchill's claim that "If a full inspiration of the gaseous oxyd be made, there would be

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[94] Samuel Latham Mitchill, "News," *Medical Repository* 1 (1798): 121.

[95] The book Davy read was Thomas Beddoes and James Watt, *Considerations on the Medicinal Powers and the Production of Factitious Airs. Five Parts in One Volume.* (Bristol: Bulgin & Rosser, 1794-1796).

a sudden extinction of life."[96] But for Davy, another repugnant aspect of Mitchill's work was his reliance on antiquated methodologies, such as using the ancient Greek medical authorities to validate his theories. Mitchill made no mention of experiment. Instead, he adhered to philosophical and historical argumentation to support his doctrine of Septon. Davy, however, liked to get his hands dirty. Suspicious of Mitchill's conclusions about the toxicity of nitrous oxide gas, Davy produced the gas himself and inhaled it, suffering no ill effects. Davy wrote up the results of his tests and sent them to Beddoes. Beddoes, with encouragement from Giddy, offered Davy the position of Superintendent of the Pneumatic Institution, a post with not much in pecuniary advantages, but a prestigious one for an inexperienced chemist.

Davy undertook another series of experiments on the gas, with the new equipment courtesy of Beddoes and the Pneumatic Institution. He first produced large quantities of nitrous oxide from zinc and diluted nitrous acid. He then decomposed nitrate of ammoniac in order to produce pure nitrous oxide.

> 200 grains of compact nitrate of ammoniac were introduced into a glass retort, and decomposed slowly by the heat of a spirit lamp. The first portions of the gas that came over were rejected, and the last received in jars containing mercury.[97]

He found that the gas exhibited at least ten unique properties, including Priestley's finding that it would not diminish in volume when mingled with nitrous gas. Although this gas was could

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[96] Samuel Latham Mitchill, *Remarks on the Gaseous Oxyde of Azote, or of Nitrogene and on the Effects It Produces When Generated in the Stomach, Inhaled into the Lungs, and Applied to the Skin: Being an Attempt to Ascertain the True Nature of Contagion , and to Explain Thereupon the Phenomena of Fever.* (New York: T & J Swords, 1795), 25.

[97] Humphry Davy, *Researches, Chemical and Philosophical, Chiefly Concerning Nitrous Oxide, or Dephlogisticated Nitrous Air, and Its Respiration.* (London: J. Johnston, 1800), 86-87.

support respiration, Davy disliked that the gas needed to be purified before it was safe to inhale. He thus determined a way to create pure and respirable nitrous oxide gas without contamination. Davy found that commonly available fibrous nitrate of ammoniac could be used to create large batches of nitrous oxide, but that it must sit for at least an hour to let any remaining nitric acid precipitate.

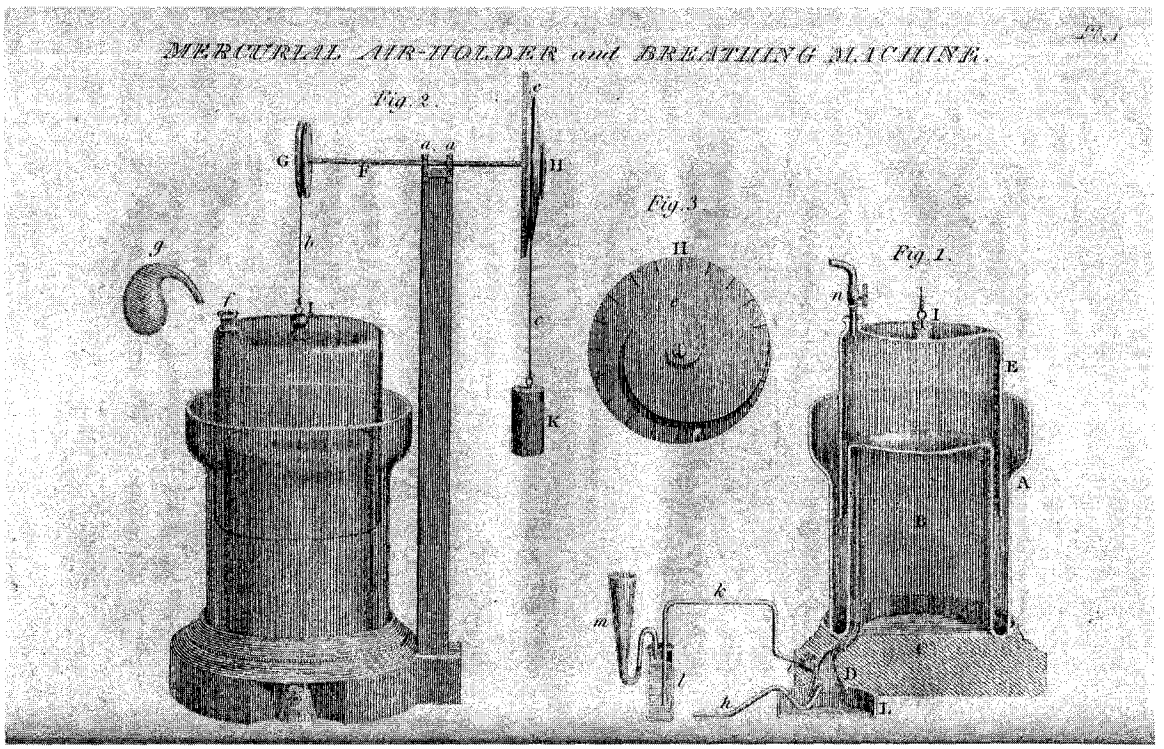

Figure 3. Watt's air holders. Davy used these to collect nitrous oxide gas. Frontispiece to Davy's *Researches*.

Davy only need four major pieces of equipment to make the gas: a glass retort with a ground stopper, a glass tube to attach to the retort, air holders filled with water saturated with nitrous oxide [see figure 3], and a common air furnace. He also suggested an even simpler, less expensive

set up for producing small amounts of nitrous oxide, happily and optimistically proclaiming the gas' potential utility to the populous.

> Thus, if the pleasurable effects, or medical properties of the nitrous oxide, should ever make it an article of general request, it may be procured with much less time, labor, and expence, [sic.] than most of the luxuries, or even necessities, of life.[98]

Now that Davy could easily and economically produce quantities of nitrous oxide gas, he began to experiment frequently on himself, inhaling small amounts of the gas to determine its effects.[99] Beddoes was on hand on one of the first occasions that Davy inhaled the gas at the Pneumatic Institution, and reported Davy's extravagant behavior under the influence of nitrous oxide.

> I saw and heard shouting, leaping, running, and other gestures, which may be supposed to be exhibited by a person who gives full loose to feelings, excited by a piece of joyful and unlooked for news.[100]

Davy's chaotic behavior surprised both Beddoes and Davy himself. They agreed that more experimentation was necessary. On 16 April 1799, Davy inhaled three quarts of the gas in the presence of Dr. Kinglake, who took Davy's pulse and found it "fuller and quicker."[101] It seemed that nitrous oxide was a stimulant. This confused Davy. Beddoes and Davy subscribed to the medical theories of John Brown, who had constructed a system based on the principles of

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[98] Humphry Davy, *Researches, Chemical and Philosophical, Chiefly Concerning Nitrous Oxide, or Dephlogisticated Nitrous Air, and Its Respiration.* (London: J. Johnston, 1800), 119-121.

[99] Davy's experiments with nitrous oxide on animals and living tissues are beyond the scope of this research project, but can be found in his *Researches.*

[100] Thomas Beddoes, *Notice of Some Observations Made at the Medical Pneumatic Institution.* (Bristol: printed by Biggs and Cottle for T.N. Longman and O. Rees London, 1799), 8.

[101] Humphry Davy, *Researches, Chemical and Philosophical, Chiefly Concerning Nitrous Oxide, or Dephlogisticated Nitrous Air, and Its Respiration.* (London: J. Johnston, 1800), 456.

excitability and excitement [see figure 4][102]. A key point of the Brunonian system of medicine was that diffusible stimuli were invariably followed by a depressive state. However, once the effects of nitrous oxide wore off, it was not followed by a depressive phase; in fact in may cases the gas left no consequent physiological symptoms once it was out of the system.[103]

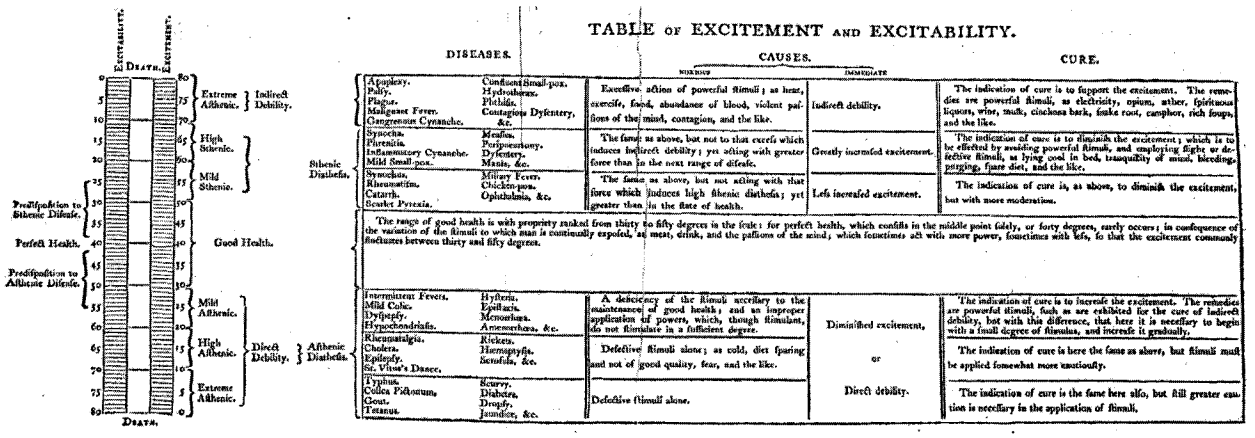

Figure 4. Brown's table of excitement, summarizing his medical principles. The diagram on the left shows how too much or too little stimulation leads inevitably to death. From the classic medical text by John Brown, Elements of Medicine.[104]

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[102] For additional information on the medical theories of John Brown, cf. Norman A. Bergman, *The Genesis of Surgical Anesthesia* (Park Ridge, IL: Wood Library-Museum of Anesthesiology, 1998), 162-164, Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820.* (Cambridge: Cambridge University Press, 1992), 159, W. R. Trotter, "John Brown and the Nonspecific Component of Human Sickness," *Perspectives in Biology and Medicine* 21 (1978): 258-264.

[103] Davy expressed the view that his work on nitrous oxide disproved Brown's theories. Cf. Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820.* (Cambridge: Cambridge University Press, 1992), 168.

[104] John Brown, *The Elements of Medicine; or, a Translation of the Elementa Medicinae Brunonis*, trans. Thomas Beddoes, vol. 1 (London: J. Johnson, 1788), 163.

The fact that this gas behaved in a manner so contrary to how it was expected to behave under the prevalent Brunonian system of medicine would continue to haunt its use after the turn of the Nineteenth-Century.

Davy decided to hone his experimental procedure to establish a closer physical link between himself and the gas. The next day Davy was careful to pinch his nostrils closed and exhaust his lungs of common air before he inhaled four quarts of nitrous oxide. He noticed his first "thrilling" sensations in connection with the gas, indistinctly recalling that his muscular power seemed to increase, causing his motions to become "various and violent."[105] Within ten minutes from this inhalation, Davy recovered completely, again noting with interest that this state of exhilaration was not followed by any noticeable depression as would be expected from Brunonian medical theory.

These inconsistencies between theory and experience led Davy to doubt that the effects of nitrous oxide were due to anything more than "enthusiasm,"[106] the late Eighteenth-Century concept that the imagination led to novel subjective sensations and radical conclusions. Davy increased his inhalation amounts to nine, then twelve quarts per session. He hoped that increasing his exposure to the gas would lead to a more pronounced physical reaction, eliminating any chance of imagination being to blame for the novel sensations. He found "...vivid ideas passed rapidly through the mind, and voluntary power was altogether destroyed, so that

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[105] Humphry Davy, *Researches, Chemical and Philosophical, Chiefly Concerning Nitrous Oxide, or Dephlogisticated Nitrous Air, and Its Respiration.* (London: J. Johnston, 1800), 457-458.

[106] Humphry Davy, *Researches, Chemical and Philosophical, Chiefly Concerning Nitrous Oxide, or Dephlogisticated Nitrous Air, and Its Respiration.* (London: J. Johnston, 1800), 459.

the mouth-piece generally dropt from my unclosed lips."[107] Between May and July of 1799, Davy habitually breathed nitrous oxide at least four to five times a week, up to four times a day. He noticed intoxication, and a plethora of new sensations and visual artifacts that he found difficult to describe. Davy became convinced that it was the gas, not his imagination, that produced these physiological effects.

In addition to his duties experimenting with nitrous oxide for the cure of disease, Davy inhaled the gas frequently for recreation.[108] He gave the gas to his friends and associates as a diversion. He included in his published works the subjective accounts of his associates as they described in detail their experiences after inhaling the gas. Davy's circle of friends included poets and socialites such as Samuel Taylor Coleridge, Josiah Wedgwood, Robert Southey, and Peter Mark Roget. Nitrous oxide became a popular party favor among this elite crowd. For example, Southey wrote a letter to Davy emphasizing his sense of vertigo when inhaling the gas.

> In breathing nitrous oxide, I could not distinguish between the first feelings it occasioned and an apprehension of which I was unable to divest myself. My first definite sensation was a dizziness, a fullness in the head, such as to induce a fear of falling. When I

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[107] Humphry Davy, *Researches, Chemical and Philosophical, Chiefly Concerning Nitrous Oxide, or Dephlogisticated Nitrous Air, and Its Respiration.* (London: J. Johnston, 1800), 460.

[108] Cf. Norman A. Bergman, "Humphry Davy's Contribution to the Introduction of Anaesthesia: A New Perspective.," *Perspectives in Biology and Medicine* 34 (1991): 534-541, Suzanne R. Hoover, "Coleridge, Humphry Davy, and Some Early Experiments with a Consciousness-Altering Drug," *Bulletin of Research in the Humanities* 81 (1978): 9-27, Christopher Lawrence, "The Power and the Glory: Humphry Davy and Romanticism," in *Romanticism and the Sciences*, ed. A. Cunningham and N. Jardine (Cambridge: Cambridge University Press, 1990), 213-227, E. M. Papper, "The Influence of Romantic Literature on the Medical Understanding of Pain and Suffering - the Stimulus to the Discovery of Anesthesia," *Perspectives in Biology and Medicine* 35, no. 3 (1992): 401-415.

> took the bag from my mouth, I immediately laughed. The laugh was involuntary but highly pleasurable, accompanied by a thrill all through me; a tingling in my toes and fingers, a sensation perfectly new and delightful.[109]

Southey also noted the involuntary propensity to laughter,[110] and emphasized that the gas affected his entire system, all the way to his fingers and toes. While Southey focused on his physical sensations, Roget reported psychological effects along with the physical excitation.

> I felt myself totally incapable of speaking, and for some time lost consciousness of where I was, or who was near me. My whole frame felt as if violently agitated: I thought I panted violently: my heart seemed to palpitate, and every artery to throb with violence; I felt a singing in my ears; all the vital motions seemed to be irresistibly hurried on, as if their equilibrium had been destroyed, and everything was running headlong into confusion. My ideas succeeded one another with extreme rapidity, thoughts rushed like a torrent through my mind, as if their velocity had been suddenly by the bursting of a barrier which before had retained them in their natural and equable course.[111]

Roget characterized nitrous oxide as a substance that can tear down those structures of the mind which he claimed dam the production of thought. Although the physical effects were interesting and pleasurable, Davy and his associates were most interested in these psychological effects of the gas, and the thrilling way in which thoughts and ideas were experienced as never before.[112]

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[109] Humphry Davy, *Researches, Chemical and Philosophical, Chiefly Concerning Nitrous Oxide, or Dephlogisticated Nitrous Air, and Its Respiration.* (London: J. Johnston, 1800), 507-508.

[110] Nitrous oxide would eventually become known as "laughing gas." By the around 1850, "laughing gas" was the colloquial term for nitrous oxide in the United States.

[111] Humphry Davy, *Researches, Chemical and Philosophical, Chiefly Concerning Nitrous Oxide, or Dephlogisticated Nitrous Air, and Its Respiration.* (London: J. Johnston, 1800), 510-511.

[112] For nitrous oxide and the Bristol circle, cf. Sophie Forgan, *Science and the Sons of Genius: Studies on Humphrey Davy* (London: Science Reviews, 1980), June Z. Fullmer, *Young Humphry Davy: The*

Beddoes was concerned about the possible ramifications that Davy's informal nitrous oxide experiments with the poets would have on his reputation. Beddoes mixed his typical optimism with concern about being branded an "enthusiast" when he stated that the work done at the Medical Pneumatic Institution might usher in a new era in medicine.

> It was plain that we might even prepare a happier era for mankind, and yet earn from the mass of our contemporaries nothing better than the title of *enthusiasts.*[113]

Making of an Experimental Scientist. (Philadelphia: American Philosophical Society, 2000), Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820.* (Cambridge: Cambridge University Press, 1992), Suzanne R. Hoover, "Coleridge, Humphry Davy, and Some Early Experiments with a Consciousness-Altering Drug," *Bulletin of Research in the Humanities* 81 (1978): 9-27, Lynn Hunt and Margaret Jacob, "The Affective Revolution in 1790s Britain," *Eighteenth-Century Studies* 34, no. 4 (2001): 491-521, Mark Kipperman, "Coleridge, Shelley, Davy, and Science's Millennium," *Criticism* 40, no. 3 (1998): 408-428, David M. Knight, "Romanticism and the Sciences," in *Romanticism and the Sciences*, ed. A. Cunningham and Nicholas Jardine (Cambridge: Cambridge University Press, 1990), 13-24, Christopher Lawrence, "The Power and the Glory: Humphry Davy and Romanticism," in *Romanticism and the Sciences*, ed. A. Cunningham and N. Jardine (Cambridge: Cambridge University Press, 1990), 213-227, Trevor H. Levere, "Dr. Thomas Beddoes (1750-1808): Science and Medicine in Politics and Society," *British Journal for the History of Science* 17 (1984): 187-204, Trevor Harvey Levere, *Poetry Realized in Nature : Samuel Taylor Coleridge and Early Nineteenth-Century Science* (Cambridge [England] ; New York: Cambridge University Press, 1981), E. M. Papper, *Romance, Poetry, and Surgical Sleep: Literature Influences Medicine, Contributions in Medical Studies, No 42* (Westport, CT: Greenwood Press, 1995), Simon Schaffer, "Genius in Romantic Natural Philosophy.," in *Romanticism and the Sciences*, ed. A. Cunningham and Nicholas Jardine (Cambridge: Cambridge University Press, 1990), 82-100, Roger Sharrock, "The Chemist and the Poet: Sir Humphry Davy and the Preface to Lyrical Ballads," *Notes and Records of the Royal Society of London* 17, no. 1 (1962): 57-76.

[113] Thomas Beddoes, Humphry Davy, and Edward Jenner, *Contributions to Physical and Medical Knowledge, Principally from the West of England* (Bristol: Printed by Biggs & Cottle, for T.N. Longman and G. Rees ..., London, 1799), 4-5.

Beddoes was aware that their hard work on pneumatic chemistry could come to naught if those outside the Institution questioned the credibility of their experiments on nitrous oxide. Unfortunately for Beddoes, within the next two years in Britain credibility and nitrous oxide became mutually exclusive. Conservatives in the late 1790s attacked Beddoes and Davy, characterizing their nitrous oxide experiments as "dangerous delusions," the result of Enlightenment ideals and related "enthusiasms".[114] Beddoes had never made a secret of his liberal politics, and the stench of revolution rubbed off onto Davy while he was in Bristol. They were attacked in the loyalist publication *Anti-Jacobin Review*, where Beddoes was characterized as full of hubris and overly optimistic about pneumatic medicine in relation to how much experimentation had actually been performed at the Institution.[115] Beddoes was indeed characterized as an "enthusiast" in the introduction to a poetic satire of his *Notice of Some Observations Made at the Medical Pneumatic Institution* entitled "The Pneumatic Revellers," published by the Anti-Jacobins.

> Dr B-----s, however, combining in his own great and comprehensive mind, the theories of Darwin and of Godwin; and applying his dephlogisticated nitrous Gas to the purposes of both these philosophers, professes his ability to turn us all into amphibious creatures (as some think, a little out of his own element)-- to repair the breaches in our constitutions, whether we have suffered from time or intemperance--to subdue disease and

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[114] Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820.* (Cambridge: Cambridge University Press, 1992), 172.

[115] "Review of 'Notice of Some Observations Made at the Pneumatic Medical Institution' by Thomas Beddoes.," *The Anti-Jacobin Review and Magazine* 6 (1800): 427-428.

> pain--to renovate in the aged, every source of pleasure, and even on earth, to render man immortal.[116]

By implying that Beddoes claimed that nitrous oxide could repair the constitution, tame pain and disease, and make man immortal, Beddoes enemies could hardly have pronounced him more enthusiastic. As a consequence, nitrous oxide was rendered the ally of the imagination, hardly the key to renewed health. Serious interest in the gas outside of Bristol never developed.

Davy left Bristol in 1800 when Count Rumford (1753-1814) invited him to present lectures to the public at the Royal Institution in London. Rumford had founded the Royal Institution in 1799 as a counterweight to the ineffective elitism of the Royal Society, hoping to bring science to a variety of social classes. Davy was appointed assistant to lecturer Thomas Garnett, and helped him demonstrate nitrous oxide in March of 1800.[117] When Garnett resigned in May 1801, Davy was appointed Professor of Chemistry, and began his rise to scientific fame through his Royal Institution lectures. Davy's lectures quickly became fashionable with the London elite, especially with scientifically curious ladies.[118] It was not uncommon to find Davy lecturing to 500 people, with Albemarle Street outside the lecture hall overrun with carriages.

In June of 1801, Davy presented a series of popular lectures on the gas, where audience members could sample nitrous oxide to determine first hand its effects. At this point in time, Davy was coming into his own as a lecturer. He realized that public demonstrations should serve to advance the authority of the experimenter and to impose order on confusion, establishing

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[116] R. Polwhele, "The Pneumatic Revellers: An Eclogue.," *The Anti-Jacobin Review and Magazine* 6 (1800): 110.

[117] Cf. June Z. Fullmer, "Letter," *Scientific American* 203, no. 2 (1960): 12-14.

[118] Cf. Jan Golinski, "Humphry Davy's Sexual Chemistry," *Configurations* 7 (1999): 15-41.

mastery over nature.[119] Demonstrating nitrous oxide for large groups was difficult, and the unpredictable behaviors and outrageous scenes caused by those sampling the gas became an attraction of their own. In response to the increasingly anarchistic behavior of his audiences, Davy began the practice of gathering a "select party of philosophers" to sample the gas privately.[120] Still, Davy found the gas unpredictable in spite of all of his attempts to refine and control its production and administration. He discontinued nitrous oxide demonstrations at the Royal Institution favoring experiments with the Voltaic pile, an object over which he could exhibit total control. Davy was content to leave his Bristol days behind him, and his association with nitrous oxide came to a close. Nitrous oxide refused to behave in public, and thus Davy banished it from polite society.

Nitrous oxide suffered another attack with the 1802 publication by James Gillray of an illustration lampooning the March 1801 Royal Institution lecture on nitrous oxide [figure 5]. This cartoon was essentially an attack on Rumford and his pretensions to democratize science. With an audience full of London's elite, the Royal Institution was portrayed as more of a social club for the rich than a crucible of scientific learning for the masses. The nitrous oxide used in this image, already having been culturally linked with Beddoes liberalism and enthusiasm, emphasized the absurdity of liberal scientific and Enlightenment ideals.

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[119] Jan Golinski, "Humphry Davy and 'the Lever of Experiment'," in *Experimental Inquiries*, ed. H. E. Le Grand (Dordrecht: Kluwer Academic Publishers, 1990), 108-109.

[120] For information on Davy's June 1801 lectures, cf. John Davy, ed., *Fragmentary Remains, Literary and Scientific, of Sir Humphry Davy, Bart. ... : With a Sketch of His Life and Selections from His Correspondence* (London: J. Churchill, 1858), 64-65. For an account of Davy's aversion to public ridicule, cf. Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820.* (Cambridge: Cambridge University Press, 1992), 201.

Figure 5. Gillray's 1802 cartoon lampooning Rumford, Davy and the Royal Institution. Gillray portrayed a mischievous Davy in custody of the nitrous oxide bellows assisting Garnett, while the audience reacted to an explosion from Sir John Coxe Hippsley's britches. Rumford looks on in amusement, while the upper-crust audience responded to Hippsley's shocking display. [121]

Whereas the informal experiments done in Bristol were recorded from the individual's perspective emphasizing the subjective aspect of inhaling nitrous oxide, Davy's Royal Institution

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[121] Thomas Wright and R. H. Evans, eds., *Historical & Descriptive Account of the Caricatures of James Gillray; Comprising a Political and Humorous History of the Latter Part of the Reign of George the Third* (London: H.G. Bohn, 1851). Plate no. 520.

demonstrations were public events designed to emphasize control over nature. The Bristol experimenters had valued the subjective experiences of those who inhaled nitrous oxide in a private setting. The idea was to allow each person a chance at a new experience and to record the variety of experiences possible under the influence of the gas. At the Royal Institution, it was the social aspects of the situation that overwhelmed the experience of the individual. Far from being a non-judgmental context for individual subjective exploration, audience members critiqued each other's behavior. These first public demonstrations of nitrous oxide at the Royal Institution would set the tone for nitrous oxide use in America during the first half of the Nineteenth-Century, when the usefulness of such events shifted from the subjective experiences of the inhaler to the public displays of one's behavior.

American Gas

After he had settled in America, Joseph Priestley was offered a chemistry chair at the University of Pennsylvania. When Priestley turned down the offer, physician Benjamin Rush suggested his former student James Woodhouse to fill the post. Woodhouse received his M.D. in 1792, with Rush as his supervisor. In 1795, Woodhouse accepted the offer and held the position until his death in 1809.

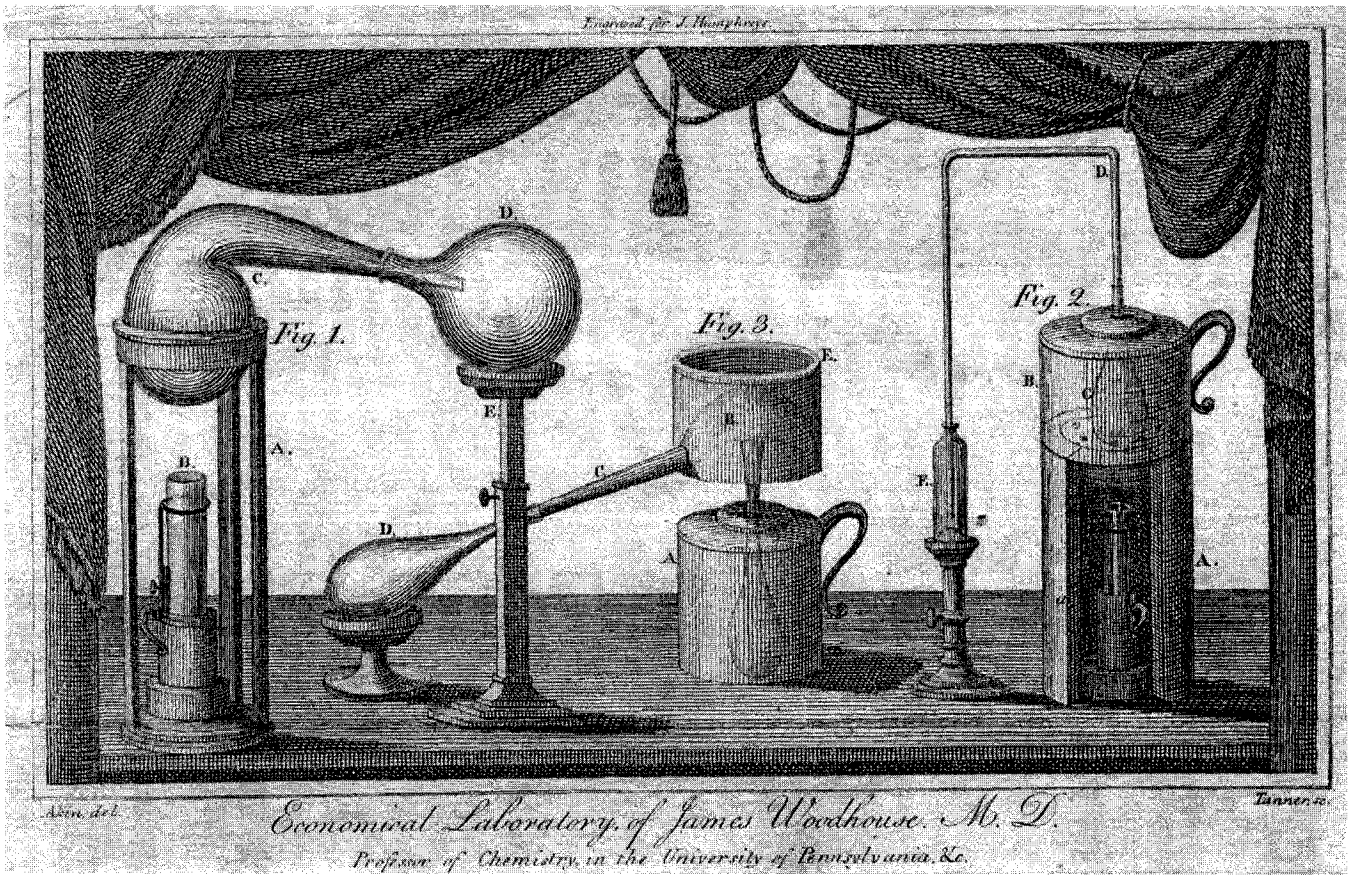

Figure 6. Woodhouse's minimalist chemical laboratory includes simple retorts for producing gases over heat.[122]

Woodhouse took leave of Pennsylvania in 1802, traveling to the Royal Institution and meeting with Humphrey Davy.[123] Upon his return from London, Woodhouse began to demonstrate nitrous oxide in his chemical lectures. An early experience was not encouraging, and suggested to him that the imagination played a greater role in the effects of nitrous oxide than physiological

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[122] Samuel Parkes, *A Chymical Catechism: Or the Application of Chymistry to the Arts* (Philadelphia: James Humphrey, 1807). Frontispiece.

[123] F. F. Smith, *James Woodhouse: A Pioneer in Chemistry, 1770-1809.* (Philadelphia: John C. Winston, 1918), 184.

changes. One morning a group of his students became eager to try the gas when they heard that Woodhouse was preparing a batch of it for class.

> In the year 1802, I prepared a large quantity of the nitrous oxide or the dephlogisticated air ... A great number of gentlemen, belonging to my chemical class, who intended to breath the gas, were present in the morning when I was filling up my air holders with it, and saw all the operations going forward. In the afternoon, being alone at my laboratory, at two o'clock the air was examined, and found to be extremely impure ... Expecting the gentlemen at three o'clock, the impure air was thrown away, and the air holders were filled with atmospheric air. This air was breathed by a variety of persons under the impression that it was the nitrous oxide. [124]

Having found that his batch of nitrous oxide was contaminated, Woodhouse replaced the defective gas with common air, and decided not to inform his students. When the students inhaled batches of ordinary atmospheric air, as Woodhouse informed Mitchill in a letter later published in the *Medical Repository*, these students exhibited a wide variety of symptoms and odd behaviors.

> Quickness of pulse, dizziness, vertigo, tinnitus aurium, difficulty of breathing, anxiety about the breast, a sensation similar to that of swinging, faintness, weakness of the knees, and nausea, which lasted from six to eight hours, were the symptoms produced by the common air we breathe, when acting under the influence of the imagination![125]

After this experience, Woodhouse was skeptical that nitrous oxide had any type of the effects on the system that Davy claimed, but, contrary to Mitchill, he was willing to admit that the gas was respirable. Woodhouse continued during the first decade of the Nineteenth-Century to include

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[124] J. Woodhouse, "Observations on the Effects of the Nitrous Oxide, When Taken into the Lungs.," *Philadelphia Medical Museum* 4 (1808): 179.

[125] Samuel Latham Mitchill, "On the Part Which the Imagination Acted in the Experiments at the Bristol Pneumatic Institution, with Nitrous Oxyd.," *Medical Repository* 5 (1802): 460-461.

the production and preparation of the gas in his lectures at the University of Pennsylvania. In 1806, he prepared some extremely pure nitrous oxide gas for his chemical lecture. For unknown reasons, on this occasion some of the students inhaled the gas. Woodhouse was surprised to find them affected.

> ... two quarts of it were administered to Mr. Henry Latrobe, fourteen years of age, who breathed it in a very fair manner. In a minute he was most violently affected ... Witnessing these effects, and knowing the impossibility of counterfeiting such symptoms, I immediately resolved to try the effects of the gas on other persons ... I am now perfectly convinced, the gas produces all the effects ascribed to it, by the justly celebrated Humphrey [sic.] Davy, who first took it into his lungs; and I am happy in having the opportunity of confirming his experiments.[126]

Woodhouse was now convinced that the behaviors he observed were not mere artifacts of imagination. He retracted his earlier conclusions about the ineffectuality of nitrous oxide gas, and was the first American to publicly support the conclusions of Humphry Davy.

One of the students who inhaled nitrous oxide that day in Woodhouse's classroom was William P. C. Barton. According to Woodhouse, Barton exhibited bizarre behaviors under the influence of the gas.

> [Barton] was very much deranged. He run [sic.] about the laboratory, bellowed like a mad bull, and struck at every person near him. A week later, the gas being administered to him a second time, produced the same effect. He felt an increase of strength, after recovering from the effects of the air. It was with great difficulty, I could remove the mouth piece of the bladder from his mouth.[127]

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[126] J. Woodhouse, "Observations on the Effects of the Nitrous Oxide, When Taken into the Lungs.," *Philadelphia Medical Museum* 4 (1808): 179-83.

[127] J. Woodhouse, "Observations on the Effects of the Nitrous Oxide, When Taken into the Lungs.," *Philadelphia Medical Museum* 4 (1808): 182.

Barton's rather extreme reactions to the gas prompted in him a fascination with the substance. He chose nitrous oxide as his primary subject of study. In 1808, Barton completed the first doctoral thesis on nitrous oxide, "A Dissertation on the Chymical Properties and Exhilarating Effects of Nitrous Oxide Gas," at the University of Pennsylvania. Woodhouse was his supervisor.

Barton had two goals in his thesis. First, he intended to collect in one place all the known information on nitrous oxide gas with the expressed purpose of applying the gas in pneumatic medicine. Second, he wanted to defend the veracity of Davy's nitrous oxide experiments at Bristol and his lectures at the Royal Institution. According to Barton, these experiments were not taken seriously in the United States.

> But the account which he [Davy] gave of its [nitrous oxide] operation was generally derided as extravagant and imaginary. Few believed it ... In the United States the chymists partook of the prevalent skepticism as to the alleged qualities of the gas.[128]

This skepticism on the part of American scientists was partially the result of the appearance in the United States of a tract critical of pneumatic medicine more generally. In 1806, Thomas Fessenden published in Philadelphia *Terrible Tractorations!!*[129] a large and expanded version of a satirical poem that he had published in London while living there in 1803. This publication had

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[128] William P. C. Barton, "Thesis: A Dissertation on the Chymical Properties and Exhilarating Effects of Nitrous Oxide Gas; and Its Application to Pneumatick Medicine, Submitted as an Inaugural Thesis of the Degree of Doctor of Medicine." (University of Pennsylvania, 1808), xiii-xv.

[129] Thomas Green Fessenden, *The Modern Philosopher; or Terrible Tractorations!! In Four Cantos; Most Respectfully Addressed to the Royal College of Physicians; by Christopher Caustic, M.D., A.S.S.*, 2nd American ed. (Philadelphia: Lorenzo Press, 1806).

originally only been critical of Benjamin Douglas Perkins and his new medicine of metal tractors that was becoming all the rage in London. For this American edition, Fessenden expanded his criticisms to include many new medical treatments, especially those with democratic and anti-loyalist associations, like the nitrous oxide experiments in Bristol. Fessenden named in his attack Priestley, Beddoes, Southey, and quoted extensively from Davy's works on nitrous oxide. He named Beddoes as his narrator's hypothetical supplier of nitrous oxide for entertainment purposes.

> Beddoes (bless the good doctor) has
> Sent me a bag full of his gas,
> Which snuffed the nose up, makes wit brighter,
> And eke a dunce an airy writer.[130]

Barton hoped to counter this poetical attack, but his work contained little new information about the gas. The only novel aspects to Barton's thesis were his accounts of some inhalations of nitrous oxide at the University of Pennsylvania that were identical in character to the reports of nitrous oxide inhalation in Davy's *Researches*, and his rather vague suggestions at the conclusion of the thesis for the use of nitrous oxide gas in pneumatic medicine. His thesis was ignored, and Barton gave up pneumatic medicine to do extensive work in botany.[131]

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[130] Fessenden was critical of the legacy of the American and French revolutions. Cf. Thomas Green Fessenden, *Democracy Unveiled, or, Tyranny Stripped of the Garb of Patriotism*, 2 vols. (New York: I. Riley & Co., 1806), 4-5.

[131] Cf. William P. C. Barton, *Compendium Florae Philadelphicae: Containing a Description of the Indigenous and Naturalized Plants Found within a Circuit of Ten Miles around Philadelphia*, 2 vols. (Philadelphia: M. Carey & Son, 1818), William P. C. Barton, *Flora of North America: Illustrated by Coloured Figures, Drawn from Nature*, 3 vols. (Philadelphia: M. Carey & Sons, 1821-1823), William P. C. Barton, *Vegetable Materia Medica of the United States, or, Medical Botany Containing a Botanical,*

An untitled and un-credited drawing was attached to Barton's thesis. This illustration parodies the more outrageous types of behavior reported by individuals under the influence of nitrous oxide.[132]

General, and Medical History of Medicinal Plants Indigenous to the United States, 2 vols. (Philadelphia: M. Carey and Son, 1817).

[132] Although the exact date of this drawing is unknown (it has been dated to the first half of the Nineteenth-Century), I believe that it is from the first decade of the Nineteenth-Century. I base this conclusion on the use of "oxyd" instead of "oxide", and the direct quotes from Davy and Fessenden littered around the image.

Figure 7 Drawing found kept in E. F. Smith's copy of Barton's thesis.[133] Quotes from top to bottom: "This world's a little dirty planet and I'll no longer help to man it," "what a concatenation of Ideas," "I feel disposed to merriment," "nothing exists but thought," "The effects of breathing Nitrous Oxyd," "the only genteel way of getting Drunk."

[133] Courtesy of the Edgar Fahs Smith Collection, University of Pennsylvania: P/C245.1 M

The quote, "nothing exists but thought," can be traced to Davy's *Researches.*[134] Another quote can be traced to the exclamations of Fessenden's narrator of *Terrible Tractorations!!* after he inhaled the nitrous oxide.

> The earth's a little dirty planet,
> And I'll no longer help to man it,
> But off will flutter, in a tangent,
> And make a harum scarum range on't![135]

This cartoon is yet another example from the early Nineteenth-Century of the lack of credibility and seriousness that was associated with nitrous oxide research. It was understood trivially, and the associations with revolutionary politics that had haunted Priestley and Beddoes continued to haunt the gas itself.

There was very little research on nitrous oxide after 1810.[136] While the Bristol Pneumatic Institute and Davy's glowing recommendations highlighted the potential utility of gases in

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[134] Humphry Davy, *Researches, Chemical and Philosophical, Chiefly Concerning Nitrous Oxide, or Dephlogisticated Nitrous Air, and Its Respiration.* (London: J. Johnston, 1800), 489.

[135] Thomas Green Fessenden, *The Modern Philosopher; or Terrible Tractorations!! In Four Cantos; Most Respectfully Addressed to the Royal College of Physicians; by Christopher Caustic, M.D., A.S.S.*, 2nd American ed. (Philadelphia: Lorenzo Press, 1806), 7.

[136] There were some intermittent publications about nitrous oxide in the early Nineteenth-Century, most related to pneumatic medicine. Cf. Dr. Back and Dr. Morgan, "Hydrophobia--Inhalation of Nitrous Oxide Gas.," *Lancet* 2 (1834): 703, Edward Jenner Coxe, *A Practical Treatise on Medical Inhalations... in Bronchitis, Consumption, and Other Diseases of the Respiratory Organs* (Philadelphia: J. Dobson, 1841), J. Curtis, "Nitrous Oxide Gas as a Remedy in Chronic Diseases of the Chest," *Lancet* 2, no. 303 (1829): 376, Michael Faraday, "Miscellaneous Intelligence. 8. Nitrous Oxide," *Journal of Science and Arts* 6 (1819): 360-361, John Hancock, *Observations on the Origin and Treatment of Cholera and Other Pestilential Diseases and on the Gaseous Oxide of Nitrogen as a Remedy in Such Diseases Etc.* (London: J. Wilson, 1831), Robert Hare, "Chemical Instruments and Operations. Protoxide of Nitrogen

general, what caused the decline of nitrous oxide use was its unpredictable effect on inhalers, along with the political context with which the gas were associated. Romanticism in general was criticized publicly by the Anti-Jacobins, who were staunch supporters of the crown in Britain and vocal opponents of any ideas generated by the French and American Revolutionaries. In Britain, the airs were dismissed as attached to political subversion and what came to been seen as the absurd ideals and promises of Romanticism.

Considering the political context and the American penchant to focus on the subjective and unique, is thus surprising that the gases did not receive more sympathetic attention in North America. Joseph Priestley had fled England in 1794 to settle in northern Pennsylvania in attempt to find religious and political sanctuary after his home and laboratory had been burned to the ground by a riotous crowd who objected to his political inclinations. The presence in America of the individual who had done so much experimentation and research on factitious airs might have been a catalyst for increased research on gases in the United States. While politics in the United States were more in line with those of the early experimenters with factitious airs in Bristol, that commonality did not survive the crossing of the Atlantic during the first decade of the Nineteenth-Century. In America, nitrous oxide was still treated in chemistry classes, but its use was limited to recreational inhalation by the students after these lectures.

However, nitrous oxide did not completely fall into disuse, and the contexts in which it was utilized during the Nineteenth-Century in America can be very revealing. It was during this period that nitrous oxide went from being trivial to intoxicating and amusing, but most

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or Nitrous Oxide," *American Journal of Science and Arts* 16 (1829): 295-299, T.W. Vincent, "On the Medical Effects of Gaseous Substances," *London Medical and Surgical Journal* 7 (1831): 45-52.

importantly it became a substance used to reveal the moral character of others. We shall now explore how gases were use in the wider antebellum American culture, and how nitrous oxide came to be understood popularly during the first half of the Nineteenth-Century.

Chapter 3. Public Exhibitions

Reading the history of medicine and chemistry literature, it would seem that nitrous oxide use tapered off after the turn of the Nineteenth-Century in North America.[137] Richard Wolfe claims that "Little or no attention was paid to nitrous oxide in works on *materia medica* and therapeutics, and it was left entirely unnoticed in most pharmacopoeias and dispensatories that appeared during the first three decades of the Nineteenth-Century."[138] In both medical and chemical circles, nitrous oxide lost its appeal. Pneumatic medicine had all but died out completely. Early optimism about the utility of the new airs which had led to the inhalation experiments in Bristol ended in disappointing and inconclusive results. Pneumatic medicine clinics closed their doors in the wake of limited positive responses to the gas and the affluent patrons dwindled away. The overall principle that factitious airs might be useful in the treatment

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[137] Cf. Norman A. Bergman, *The Genesis of Surgical Anesthesia* (Park Ridge, IL: Wood Library-Museum of Anesthesiology, 1998), 333-342, F. F. Cartwright, *The English Pioneers of Anesthesia (Beddoes, Davy, Hickman).* (Bristol: John Wright, 1952), 309-331, Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820.* (Cambridge: Cambridge University Press, 1992), 175, W. D. A. Smith, *Under the Influence: A History of Nitrous Oxide and Oxygen Anaesthesia* (London: Macmillan Publishers, 1982), 33-38. This can also be implied by the tapering off of publications on nitrous oxide in scientific and chemical journals in America during the first few decades of the Nineteenth-Century. Although some isolated experimentation continued, it was far from the central feature of any medical or chemical research program.

[138] Richard J. Wolfe, "Who Was the Discoverer of Surgical Anesthesia? A Brief for Horace Wells.," in *I Awaken to Glory: Essays Celebrating Horace Wells*, ed. Richard J. & Menczer Wolfe, Leonard F. (Boston: Boston Medical Library, 1994), 10.

of disease was dismissed by surgeons and medical practitioners. Pneumatic chemistry, although still popular in the context of teaching, was not a research priority in North America. Faced with the decline in interest in both medical and chemical circles, many historians have assumed nitrous oxide fell into obscurity during the first half of the Nineteenth-Century.

However, this is not the case. Nitrous oxide gas was a well known and often used substance during the first half of the Nineteenth-Century, and many new ideas about the gas were generated. This chapter starts by exposing two historical myths surrounding the use of nitrous oxide: the myth of expense and the myth of complexity. Contrary to the assumptions of some historians, nitrous oxide was neither prohibitively costly nor difficult or complicated to produce.

My research shows that several key concepts regarding the gas emerged and were reinforced in antebellum America. The first is the continued emphasis on the unpredictable behaviors that individuals exhibited upon inhaling the gas. This unpredictability became essential in establishing nitrous oxide as a subject of popular entertainment. Second, nitrous oxide became known as a tool to aid in determining an individual's character during a period when looks became deceiving. This particular use of the gas serves to explain the popularity of nitrous oxide exhibitions, a practice that emerged at the start of the Nineteenth-Century in America and continued well into the Victorian Era. This chapter shows how knowledge about nitrous oxide was generated and perpetuated throughout American culture as a substance associated with entertainment and amusement.

The myths of expense and complexity

One misconception that has caused historians to ignore the popularity of nitrous oxide use during this period has been the implicit assumption that the gas was both costly and difficult to produce. Norman Bergman stated, "It [nitrous oxide] was limited to those who had access to the chemicals and the bulky, expensive, gas-generating apparatus as well as the chemical manipulative skill required to prepare the gas so that it was free of toxic contaminants."[139] However, as we saw in Chapter 2, Davy demonstrated that nitrous oxide could be produced with a few simple bits of apparatus. Although not easy to store, it was far from prohibitive to those motivated to create and inhale it. In contrast, David Knight has emphasized just how many people dabbled with the gases: "...it was accessible. For a small outlay, the apparatus necessary to prepare the new gases or 'factitious airs,' could be purchased."[140] The raw chemical materials necessary to produce nitrous oxide were not expensive, and neither was the simple equipment needed for its production.

Knowledge of how to produce the gas was far from arcane. It could be found in any of the popular books on chemistry produced in the first few decades of the Nineteenth-Century, as well as in the works of Priestley and Davy. The apparatus was simple to use and the gas was easy to administer, as a chemistry textbook from 1819 explained:

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[139] Norman A. Bergman, "Frivolous Uses of Anesthetic Gases : Some Historical Aspects," *American Society of Anesthesiologists newsletter* 59, no. 11 (1995): 18.

[140] David M. Knight, "Communicating Chemistry. The Frontier between Popular Books and Textbooks in Britain During the First Half of the Nineteenth Century," in *Communicating Chemistry: Textbooks and Their Audiences 1789-1939*, ed. Anders Lundgren and Bernadette Bensaude-Vincent (Canton, MA: Science History Publications, 2000), 187.

> To administer the gas, it may be introduced into a bladder or oiled silk bag, furnished with a stop-cock, and may be inhaled, as long as any remains in the bladder.[141]

As early as 1808 the Medical Repository published that "A boy of common dexterity, after being once taught, would be fully competent to its [nitrous oxide] preparation."[142] Rather than being a difficult process that was only possible by those with specific laboratory experience and techniques at their disposal, producing batches of nitrous oxide was possible by anyone who was willing to learn some basic chemistry. With just a glass retort, some glass tubing, a furnace and air holders, anyone could produce small batches on nitrous oxide suitable for breathing, and many people did.

Having established that the cost and complexity of producing nitrous oxide gas were not legitimate factors prohibiting the creation and use of the gas, we must determine if and how it was used and understood. As we have seen, the majority of historians assume that because nitrous oxide was not the subject of intense research in scientific and medical contexts that it was utterly disregarded and absent from Nineteenth-Century life. The remainder of this chapter serves to remedy this oversight by examining the strange and circuitous way that nitrous oxide became a substance of importance in popular culture. From informal lectures to grand exhibitions, nitrous oxide was a famous, if somewhat notorious, American pastime.

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[141] Thomas D. Mitchell, *Medical Chemistry or a Compendious View of the Various Substances in the Practice of Medicine, That Depend on Chemical Principles for Their Formation; Designed for the Use of Medical Students. To Which Is Appended, a Discourse on the Medical Character.* (n/a: n/a, 1819), 14.

[142] "Mr. Griscom's Lectures on Chemistry," *Medical Repository* II, no. 3 (1808): 322.

From the classroom to the lecture hall

Many Nineteenth-Century chemical lecturers first learned the preparation of nitrous oxide while enrolled in courses on medicine or chemistry. Nitrous oxide was included in the curriculum in most chemical and medical educations. Thomas Mitchell for example, wrote up a section on nitrous oxide in his popular 1819 chemistry textbook, *Medical Chemistry.*[143] As Wolfe has noted, after around 1830 every chemistry book and every book on *materia medica* included a section on nitrous oxide.[144]

Even though it did not become a popular textbook topic until the 1830s, nitrous oxide was part of the overall chemical and medical course curriculum in America from the early part of the Nineteenth-Century. Professors encouraged their students to make their own nitrous oxide as part of laboratory practicum. When lecturing on chemistry and gas production in the classroom, it was standard practice for instructors to encourage students to create the gas themselves and then to partake of it after class. As a result, the gas became commonly used by medical students as an intoxicant, where first hand experience of the gas was considered not an official part of the curriculum, but a social custom in medical schools.

> For several years, the medical class, and two senior academical classes in Yale College, while attending the chemical lectures, have been in the habit (each class by itself) of preparing for themselves,

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[143] Thomas D. Mitchell, *Medical Chemistry or a Compendious View of the Various Substances in the Practice of Medicine, That Depend on Chemical Principles for Their Formation; Designed for the Use of Medical Students. To Which Is Appended, a Discourse on the Medical Character.* (n/a: n/a, 1819).

[144] Richard J. Wolfe, "Who Was the Discoverer of Surgical Anesthesia? A Brief for Horace Wells.," in *I Awaken to Glory: Essays Celebrating Horace Wells*, ed. Richard J. & Menczer Wolfe, Leonard F. (Boston: Boston Medical Library, 1994), 14.

> and administering to their respective members, the nitrous oxide, or exhilarating gas.[145]

Dr. E. E. Marcy, a physician in Hartford, Connecticut, recalled that "When he was a student at Amherst College, he, and other students, had often inhaled nitrous oxide gas, and also the vapor of sulphuric ether, for their own amusement."[146] Inhaling the gas after class turned into a rite of passage for students of chemistry and medicine. It was a bonding experience, one not directly ordained by the educational faculty, but one encouraged with a metaphorical wink from the professors. Younger students were also exposed to the gas. Henry Barnard recalled that he inhaled the gas at school at the tender age of twelve.

> I happened to be a student of Monson Academy, of which my friend opposite was also a member. The principal or preceptor of the Academy was Benjamin Silliman, who in early practice in Yale College always gave a day to laughing gas, and when he became principal of the Academy it was one of the first things that he did. In the course of the year he gave an exhibition of the effects of nitrous oxide. Very few ventured forward to take it. As I was then a lad some twelve years of age, and thought somewhat courageous, I was pushed forward to take it.[147]

Thus even young students in school took the gas, and experienced its effects. Silliman, one of the most famous American scientists of the early Nineteenth-Century, encouraged many of his students to try the gas. This sampling of the gas by students was a typical practice, one that continued late into the Nineteenth-Century.

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[145] "Domestic," *American* 5, no. 1 (1822): 194.

[146] Laird W Nevius, *The Discovery of Modern Anaesthesia: By Whom Was It Made? A Brief Statement of Facts* (New York City: George W. Nevius, Cooper Institute, 1894), 35.

[147] Henry Barnard, "Wells Memorial Celebration: Hon. Henry Barnard, L. L. D., of Hartford," in *Notes on the History of Anaesthesia the Wells Memorial Celebration at Hartford, 1894 Early Record of Dentists in Connecticut*, ed. James McManus (Hartford: Clark & Smith, 1896), 49-50.

It occurred to some students that the popularity of private nitrous oxide sampling parties amongst their peers could lend itself to profit if the general public were exposed to the remarkable effects of the gas. An 1827 obituary for Professor of Chemistry James Freeman mentions how a young man named Dana gave a nitrous oxide demonstration as a student at Harvard:

> In 1813 he commenced his medical studies, and during the winter, with the consent of Professor Gorham to use his lecture room, he gave a public lecture on nitrous oxide, accompanying it with an exhibition of its effects.[148]

Chemist Dana was not the only student turned public lecturer. Samuel Colt, inventor of the revolver, studied chemistry privately under the guidance of amateur scientist William Smith. Colt went on to exhibit nitrous oxide at a variety of locations along the eastern seaboard, using the profits from his traveling spectacles in the early 1830s to patent his new gun.[149] Many itinerant 'professors' of chemistry emerged during the antebellum period, traveling the towns and villages of the country, lecturing on the gas and demonstrating the exhilarating effects of nitrous oxide.

Consequently, as knowledge about the effects of nitrous oxide on the human system became well known, generalist magazines and newspapers frequently reported its effects. As early as 1822, knowledge about the gas was deemed to be commonplace.

> The relations of the effects of this gas have been so frequent, and similar, that they have become trite.[150]

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[148] J. B. B., "Obituary," *The New York Medical and Physical Journal* 6, no. 2 (1827): 314.

[149] Jack Rohan, *Yankee Arms Maker: The Incredible Career of Samuel Colt* (New York: Harper & Brothers, 1935), 26.

[150] "Domestic," *American* 5, no. 1 (1822): 194.

The fact that reports chronicling the consequences of nitrous oxide inhalation were considered stale and redundant by the 1820s testifies to the gas' popularity and adds weight to the conclusion that nitrous oxide was a well known aspect of early Nineteenth-Century life in America.

The unpredictable exhilarating air

The contexts in which nitrous oxide gas was produced and used tell us much about perceptions of the gas during the first half of the Nineteenth-Century. We shall now look at knowledge production and how nitrous oxide was understood by the average middle class American.

A report from France re-published in *The Philadelphia Medical Museum*, outlining some of the effects of nitrous oxide experiments done by a group of amateurs, emphasizes one characteristic of nitrous oxide that can be found again and again in early Nineteenth-Century accounts of inhalation: the unpredictable results of combining the gas with individual inhalers. Much like Davy in his early reports of inhalation antics, M. Dispan emphasized not a set of similarities, but the different individual reactions upon inhalation.

> The third experienced a saccharine taste on the first inspiration, but was insensible to those which succeeded; his lungs forcibly dilated with great heat. When the bladder was removed, he appeared very comfortable, but did not refrain from violent bursts of laughter.[151]

Whereas the first individuals in this trial found the gas pleasant and tasteless, this third experimenter noticed a sweet taste, and a warm expansion of the lungs. Variability in the quality

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[151] M. P. Dispan, "Experiments on the Gaseous Oxide of Azote, by a Society of Amateurs, at Toulouse; Communicated by M. P. Dispan, Professor of Chemistry in the College of That City, to the Editors of the Annales of Chemie.," *Philadelphia Medical Museum* 4, no. 4 (1808): 54-58.

of the gas was sometimes responsible for the variety of reactions that those inhaling it displayed. In this case we have a report chronicling the inhalation of what might have been some gas contaminated with nitric acid.

> Twelve persons were subjected to the experiment, and on many it was repeated. Most of them had inhaled the gas on former trials, when two out of seven experienced pleasing sensations, but on the present occasion not one felt pleasure; on the contrary, they all felt pain, and many of them suffered severely.[152]

Dispan arrives at an interesting conclusion from this occasion. He did not question the purity of the gas, but implied that the gas itself contained properties that produce shifting and unpredictable reactions in the human body. Rather than concluding that a particular batch of gas might somehow be constitutionally different from the gas used earlier, Dispan concluded that the gas itself is somehow unstable and changeable.

> M. Dispan is of the opinion, from everything he observed, that it will be extremely difficult to reduce the effects of gaseous oxide of azote to any general system, as they very so considerably on different individuals : and, what is more singular, even on the same person.[153]

Dispan's publication is one early example of one who promulgated the idea that there was something very unpredictable about nitrous oxide gas in combination with the human constitution. This unpredictability emerged as an aspect of nitrous oxide inhalation that was

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[152] M. P. Dispan, "Experiments on the Gaseous Oxide of Azote, by a Society of Amateurs, at Toulouse; Communicated by M. P. Dispan, Professor of Chemistry in the College of That City, to the Editors of the Annales of Chemie.," *Philadelphia Medical Museum* 4, no. 4 (1808): 57.

[153] M. P. Dispan, "Experiments on the Gaseous Oxide of Azote, by a Society of Amateurs, at Toulouse; Communicated by M. P. Dispan, Professor of Chemistry in the College of That City, to the Editors of the Annales of Chemie.," *Philadelphia Medical Museum* 4, no. 4 (1808): 58.

both important to the rise of its popularity, but necessary to the maintenance of this popularity throughout the first half of the Nineteenth-Century.

In the United States, gas production appeared to be unproblematic at the end of the first decade of the Nineteenth-Century, and enterprising individuals saw the pecuniary advantages to administering the gas to a wider audience than amateur chemists. Mr. Griscom's lectures in New York during 1807 were some of the earliest chemical lectures in the United States to be addressed to popular audiences. He lectured specifically on chemistry, and emphasized the peculiar effects of nitrous oxide on the human subject. Griscom, like Davy and Dispan, highlighted the unpredictable reactions of the inhalers. Griscom noted that fainting from the gas was rare, and contrasted this behavior with others who inhaled nitrous oxide.

> The second who tried the experiment, after having received about half his portion, instantly stopped short, cast a wild look about him, and immediately fainted.[154]

Griscom's accounts differed from those of Davy in that Griscom concentrated on observing and recording the behavior of individuals who had taken the gas, rather than relying on the first hand accounts of the inhalers. In doing so Griscom alters the focus from the subjective experiences of the individual inhaler to the outward behaviors of the inhaler, foreshadowing the way in which the American public would come to understand the utility of nitrous oxide. In this next case, the individual was not compelled to laugh like most inhalers, but behaved with a certain propriety and reservation consistent with his public persona.

> A fifth, whose gravity in private life is seldom disturbed by a smile, advanced to the pipe. After finishing his draft, he turned towards the spectators with a stern aspect; and then, as if his mind were

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[154] "Mr. Griscom's Lectures on Chemistry," *Medical Repository* II, no. 3 (1808): 323.

> dwelling on themes beyond the ken of mortals, proudly stalked over the floor to his seat. He felt no disposition to laugh.[155]

Whereas the earlier example of nitrous oxide inhalation demonstrated how restraint and gentility emerged in the inhaler, this time around the inhaler could not overcome his propensity for boisterous behavior. In yet another instance, the individual was completely overwhelmed by the effects of the gas, and behaved outwardly in a manner not commonly seen in polite society.

> This person went to the pipe with a determination to exhibit none of the effects which have been witnessed. However, after taking his draught, and having the pipe wrested from his mouth, he was instantly divested of the ordinary functions of intellect. The world appeared (as he has since described it) like a phantom in the semblance of Paradise before him; and every visible thing seemed to be exhibited only to inspire ecstacy [sic.] and joy. Under this impression, and eager to take his proportion of the felicity, he broke into most boisterous laughter, clapped his hands, jumped up and down, with many whimsical antic capers, dashed his hat on the floor, uttered several incoherent ejaculations, then flew to his seat.[156]

By contrasting these three reactions to nitrous oxide, Griscom concluded that gas did not cause the same predictable behaviors in different individuals. In his lectures, one of the earliest public displays in America of the effects of nitrous oxide gas, Griscom focused on the different outward behaviors, not the different subjective experiences, of those who took the gas. His lectures paved the way for more popular representations of the factitious air, and his recollections illustrate how even these early chemical lectures served to emphasize the unpredictability of the effects of the gas on those who chose to inhale it, in contrast with Davy's earlier emphasis on the inward subjective experiences of those who inhaled. This change in emphasis demonstrates the shift

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[155] "Mr. Griscom's Lectures on Chemistry," *Medical Repository* II, no. 3 (1808): 323.

[156] "Mr. Griscom's Lectures on Chemistry," *Medical Repository* II, no. 3 (1808): 324.

from the Romantic-influenced subjectivity of the inhaler to the testimony of the external objective observer and how his interpretations were used in assessing an individual's character.

The first published account of the public exhibition of nitrous oxide for entertainment purposes in the United States was the anonymous text, *A Cursory Glimpse of the State of the Nation.*[157] Prior to these displays, nitrous oxide had not been an object accessible by everyday Americans. Americans without medical or chemical training had not been exposed in any way to the wonders of this exhilarating air. They were a rapt audience for this new set of phenomena. As the title implies, this early account links together scientific, political and religious ideas under the umbrella description and metaphor of a nitrous oxide demonstration. The tract starts off outlining the relationship between nitrous oxide and common air, also reviewing properties and aspects of the gas generally known in chemical circles. The author then states that he noticed an advertisement in the *Philadelphia Gazette* for the very last of Dr. Jones weekly lectures on nitrous oxide; and he thus procured a ticket. The fact that the author notes that that these events were common; they occurred weekly, combined with the narrator's general nonchalance about the event, imply that these demonstrations of nitrous oxide were becoming common during the second decade of the Nineteenth-Century, and did not appear to be novel. Although billed as a

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[157] *A Cursory Glimpse of the State of the Nation, on the Twenty-Second of February, 1814, Being the Eighty-First Anniversary of the Birth of Washington; or a Physico-Politico-Theologico, Lucubration Upon the Wonderful Properties of Nitrous Oxide, or the Newly Discovered Exhilarating Gas, in Its Effects Upon the Human Mind, and Body; as They Were Exhibited, by Actual Experiment; on the Evening of the Twenty-Third Instant.* (Philadelphia: Moses Thomas, 1814). Smith cites the earliest use of nitrous oxide as entertainment as 1824, in London. This Philadelphia exhibit predates Smith's findings by ten years. W. D. A. Smith, *Under the Influence: A History of Nitrous Oxide and Oxygen Anaesthesia* (London: Macmillan Publishers, 1982), 34.

lecture, supposedly an educational experience, the audience seemed more interested in the post inhalation antics of their peers.

> When the doctor has descanted, at sufficient length, upon the nature and properties of nitrous oxide; and exhibited a number of unimportant experiments, to which very little attention is paid by his audience, who come rather to see - than to hear; he begins to perceive the impatience, particularly on the female part of the company, and he proposes to deliver ten or twelve tickets, regularly numbered, to so many young gentlemen who may have mind to inhale the exhilarating gas.[158]

Even though the lecturer seemed to want to couch his demonstration in propriety, displaying "unimportant experiments" utilizing the gas, his audience was far more interested in the unusual behaviors that fellow members of the gathering would have under the influence of nitrous oxide. The narrator of this account described a variety of reactions that the young men had upon exposure to the gas, and was struck by the similarity between some of the rash and impulsive behavior of the young men on nitrous oxide gas and what he takes to be the impulsive propensity of the United States military to engage Canada in territorial skirmishes.[159] Nitrous oxide was in this case a catalyst of thoughtless behavior. The author concluded by railing on the silliness of atheism and military hubris; both being analogous, on his view, to nitrous oxide intoxication.

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[158] *A Cursory Glimpse of the State of the Nation, on the Twenty-Second of February, 1814, Being the Eighty-First Anniversary of the Birth of Washington; or a Physico-Politico-Theologico, Lucubration Upon the Wonderful Properties of Nitrous Oxide, or the Newly Discovered Exhilarating Gas, in Its Effects Upon the Human Mind, and Body; as They Were Exhibited, by Actual Experiment; on the Evening of the Twenty-Third Instant.* (Philadelphia: Moses Thomas, 1814), 4.

[159] It appears that no women partook of the gas this early on in the Nineteenth-Century, and certainly not at this particular exhibition.

This short publication tells us a great deal about nitrous oxide use in the United States during the second decade of the Nineteenth-Century. First, the chemical properties of nitrous oxide may not have been well known to the reading public. The author felt it necessary to explain these properties of nitrous oxide at the beginning of his pamphlet, implying that he assumed that knowledge about the chemical particulars of gas was not known by his intended audience. However, the fact that the newspaper advertised a weekly lecture on nitrous oxide did not merit any particular notice. It would seem that at this point in time the intended audience for this pamphlet would have been familiar with nitrous oxide lecture demonstrations.

Other aspects of the text are telling. The author notes how the audience, particularly the female members of the audience, grew impatient as the doctor explained the history and chemistry of the gas. According to the author, they were interested in "seeing," not "hearing." This can be taken as evidence that nitrous oxide lectures were from their earliest incarnations taken to be spectacles, and consequently subject to view by a large varied audience for the purposes of amusement. The façade of education and scientific instruction put forth by these lecturers was cracking in the face of public demand for amusements. In the process, the unpredictability that had been such a negative aspect of earlier nitrous oxide use was eventually understood as a positive feature of nitrous oxide inhalation, the very core of its entertainment value.

The character revealed

Contemporary cultural historian Karen Halttunen noted a crisis that she claims emerged in antebellum America. She proposes that radical changes in the overall social structure, resulting from the emergent Industrial Revolution and its ramification on urbanization, led to a

problem in identifying the moral character of fellow citizens. It became progressively more difficult to tell the proper gentleman from his immoral imposter, the confidence-man.

> The social and economic changes of the eighteenth and early Nineteenth-Century had disrupted these older norms and left a vacuum of prescriptive guidance on how to interact with others ... To resolve this antebellum crisis of social confidence, a new system of cultural forms was needed within which Americans seeking to rise in the world of strangers might meet without fear of moral or psychological injury.[160]

Halttunen argues that advice manuals geared towards young men, simplified styles in woman's clothing, and the increased stringency surrounding mourning rituals served to indicate inner character in a world where such character became harder and harder to recognize. I argue that nitrous oxide demonstrations provided another outlet for seeing vivid displays of moral constitutions in antebellum America. The behaviors of an individual on nitrous oxide came to be seen throughout the first half of the Nineteenth-Century as a reliable indicator of his true character.

One of the earliest indications that nitrous oxide was thought to reveal true character can be found in an odd letter to the editor that appeared in *The Philadelphia Reportory* in 1812. A female writer calling herself "Quillet Quiz" reported that she attended a nitrous oxide lecture and exhibition. However, rather than simply stating the events of the evening, the author instead chose to recount a "dream" that she had about the event later the same night. In this odd mixture of truth and fiction, Quillet Quiz was able to portray her own behaviors after she inhaled the gas in a morally acceptable light.

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[160] Karen Halttunen, *Confidence Men and Painted Women: A Study of Middle-Class Culture in America, 1830-1870* (New Haven, CT: Yale University Press, 1982), 193.

> I am about to offer my observations upon this visit and I am convinced you will think this chemical discovery of great utility to mankind. I am too modest to say how it operated upon me, lest you should think me vain. When I went home I retired to rest with my head full of the wonderful properties of this gas and the following dream was the consequence.[161]

Her self-proclaimed modesty implies that her behavior under the influence of the gas was impeccable. Obviously, she displayed all the behaviors proper to an antebellum lady. However, her observations of how others acted at the event, written in the form of the semi-fictional dream sequence, are somewhat less flattering. She changed the names of her fellow participants, but still managed to display their social faults: "Mrs. Clatter" had the problem of chattering nonstop while on the gas while "Miss Amour" embraced and kissed every man in the room, fleeing in embarrassment once the nitrous oxide had worn off. The gas had served to reveal the faults of individuals who might otherwise have been seen as upstanding individuals.

It was during this second decade of the Nineteenth-Century that nitrous oxide went from being an interesting part of a chemical lecture series to an entertainment headliner. When discussing his visits to America, Londoner William Faux recalled an early nitrous oxide lecture, dated sometime in 1818:

> We passed the evening with Mr. —-, a member of Congress, who had obligingly shewn us whatever was thought worth viewing, and some amusement was offered at a lecture upon the laughing gas, in

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[161] Quillet Quiz, "Nitrous Oxide Gas.," *The Philadelphia Reportory Devoted to Literature and Useful Intelligence* 41, no. 2 (1812): 326.

> seeing its ludicrous effects upon several individuals of the company who inhaled it.[162]

It is telling the anonymous member of Congress would have chosen to take Faux, a visitor to America, and his party to a laughing gas demonstration. Although Faux states that those taking the gas behaved absurdly, as a foreigner, he did not make any moral judgments upon them. Faux's testimony indicates that by the late teens, these demonstrations had become popular evening entertainments and local attractions worthy of the attention of foreigners.

Mr. Forrest, an actor, remembered how he was first encouraged to be a professional thespian when he was a boy in the second decade of the Nineteenth-Century. As the result of taking nitrous oxide, his dramatic talents were exposed.

> A crowd was gathered one evening at the Tivoli Garden to behold the curious varieties of delirium men exhibit on inhaling nitrous oxide gas... Among those to whom the intoxicating agent was administered (on the occasion referred to) there chanced to be a little unfriended boy, who, in the instant exstacy [sic.] which the subtle fluid inspired, threw himself into a tragic attitude, and commenced a passage from one of Shakespeare's plays... a stranger stepped from the crowd, taking him by the hand pronounced the words that thrilled through him with a spell-like influence. 'This boy,' said he, 'has the germ of tragic greatness in him. The exhilarating gas has given him no new power. It has only revealed one which lay dormant in him before."[163]

The potential for dramatic greatness became manifest after the boy inhaled the gas. It was understood in this case to reveal a previously concealed special talent or propensity, which was

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[162] William Faux, *Early Western Travels. Vol. 12: Part I I of Faux's Memorable Days in America. 1819-1820: Welby's Visit to North America*, ed. Reuben Gold Thwaites (Cleveland, OH: A.H. Clark Co., 1904), 341.

[163] "The Drama," *The Southern Literary Journal and Magazine* 3, no. 2 (1838): 158-159.

then encouraged. Nitrous oxide serve to reveal a part of the young boy's psyche which had laid dormant. Only when under the influence of the gas was he able to free his true self.

Nitrous oxide demonstrations grew in popularity throughout the 1820s. Dr. Preston ran a successful series of demonstrations in New York City at the City Hotel in 1820 and 1821.[164] In one advertisement, he emphasized how he arranged special accommodations to cater to the ladies, emphasizing propriety and decorum. His tickets were sold at a variety of locations, including A. T. Goodrich's book store, the Office of the Ladies Literary Cabinet, and E. Audler's drug store.[165] This variety of outlets, along with his emphasis on the special setting for the ladies, shows how Dr. Preston was concerned with presenting his nitrous oxide lecture as moral entertainment for proper gentlemen and ladies, in contrast with the baser traveling shows that proliferated during the period.

Yet there was also a less genteel audience for nitrous oxide demonstrations. Nitrous oxide was also demonstrated at Dime Museums in the United States, loci of amusement and entertainment where the focus shifted from the 'useful knowledge' movement popular in the first decades of the century to popular tastes and novelty. These museums were responsible for presenting technical and scientific knowledge in an amusing way to an audience that included a variety of social classes.[166] In the earliest American museums, such as Peale's Museum in Philadelphia, entertainment and education were combined under the rubric of "useful

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[164] "Classified Advertisement," *New York Evening Post* March 7, 1820, 3, "Classified Advertisement," *New York Evening Post* March 2, 1821, 3.

[165] "Classified Advertisement," *New York Evening Post* March 7, 1820, 3.

[166] Cf. Andrea Stulman Dennett, *Weird and Wonderful: The Dime Museum in America* (New York: New York University Press, 1997).

knowledge," information that would educate and enlighten the average American citizen. Peale's Museum contained both items of natural history and fine art. Dime Museums, however, redefined the traditional museum as exemplified by Peale as any building that contained a variety of exhibits and entertainments, such as human and animal oddities, magicians, wax figures, fossils, moral lectures and lantern shows.[167] In theory, such locations functioned as the perfect Jacksonian amalgamation of the display of useful knowledge and the amusement demanded by the masses. In practice, they were robust locales for a varied range of stimulating amusements. Middle and lower class Americans hated European opera and literary drama, viewing it as an extension of elitist snobbery and the antithesis of the Jacksonian era's focus on individual merit and egalitarian principles.[168] Dime Museums emphasized the growing demand for entertainment not derived from European high culture, and defined themselves as particularly American entertainment.

Nitrous oxide was demonstrated at the New England Museum in Boston, Massachusetts in 1820. Dr. Locke made a demonstration in early January of that year and a report of the event was written up in the *Ladies' Port Folio* by the "Friends of Science." The authors reported that inhalers of the gas behaved in ways that might be expected, with the "green horn" from the country, for example, becoming more lethargic and exhibiting a lack of

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[167] A. Anderson, *Snake Oil, Hustlers and Hambones: The American Medicine Show.* (Jefferson, NC: McFarland & Company, 2000), 49.

[168] For a discussion, cf. Lawrence Levine, "William Shakespeare and the American People: A Study in Cultural Transformation," *American Historical Review* 89, no. 1 (1984), Lawrence W. Levine, *Highbrow/Lowbrow: The Emergence of Cultural Hierarchy in America* (Cambridge, MA: Harvard University Press, 1988).

intelligence.[169] This rather insulting view was challenged a few weeks later in the same magazine, when an author billing himself simply as "an observer" wrote:

> The writer inferred that its [nitrous oxide] effects on the second person indicated "stupidity" of character... I am far from the opinion that the inference was in any degree correct. Although the nitrous oxide is said to be a developer of real character, yet it is known to effect people according to the state they are in at the time.[170]

Thus the author argues not that it was not the individual's stupidity that was revealed, but his state of mind at the time of the inhalation. Was it not possible that an inner life consumed by turmoil would manifest itself in a lethargic exterior persona?. This example emphasizes the negotiations between audiences and participants that typified these demonstrations. Because the effects of nitrous oxide were so varied and included gradations in outward behaviors, there was a certain amount of interpretation that was left up to the audience, who were active participants in the construction of knowledge about their peers, with the assistance of nitrous oxide gas.

By 1824, the Western Museum, a dime museum in Cincinnati, featured nitrous oxide as a staple attraction:

> On Saturday evening Mr. Dorfeuille will lecture on the fifth order of birds (*Gallinacous [sic.], or poultry*) after which the NITROUS OXIDE will be administered.[171]

The Western Museum also exhibited moral entertainments, such as panoramas of Hell, which subjected viewers to the harsh consequences of immoral living.[172] This museum was a location for

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[169] Friends of Science, "Nitrous Oxide," *Ladies Port Folio* 1, no. 5 (1820): 39.

[170] An Observer, "Nitrous Oxide," *Ladies Port Folio* 1, no. 7 (1820): 54.

[171] Anti-Dram, "Cheap Drunkenness," *American Mechanics Magazine* 1, no. 7 (1825): 55.

disparate and unusual entertainment, from the traits of poultry to the behaviors of mankind. Even so, the exhibitions were thematically linked to promote current social norms. For example, the moral panoramas served as a constant reminder to their observers that the goodness of the individual was apparently universally desirable.

By the 1830s, advertisements for nitrous oxide demonstrations were commonplace. These notices focused on the varied and unusual behavior of the individuals who inhaled the gas. An Albany, NY notice for an exhibit at a Dime Museum by Samuel Colt emphasizes the novelty and unpredictability associated with nitrous oxide.

> The effect which the gas produces upon the system is truly astonishing. The person who inhales it becomes completely insensible, and remains in that state for about the space of three minutes, when his senses become restored, he sneaks off with much shame as if he had been guilty of some mean action. No person will begrudge his two shillings for the gratification of half an hour's laugh at the ludicrous feats displayed in the lecture room.[173]

Part of the fun of the event was the chance for people to laugh at the unpredictable antics of their friends and neighbors, including their much anticipated social gaffs. In this sense, nitrous oxide exhibitions functioned as a type of novelty exhibition similar to the novelties found in Dime Museums. The promise of "ludicrous feats" emphasized the element of the absurd and unknown. Grayson mentioned in passing that this unusual and abnormal behavior was similar to the "freak

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[172] For information on the Western Museum, cf. M. H. Dunlop, "Curiosities Too Numerous to Mention: Early Regionalism and Cincinnati's Western Museum," *American Quarterly* 36, no. 4 (1984): 524-548.

[173] "Museum," *Microscope* October 26, 1833, n.p. Quoted in Jack Rohan, *Yankee Arms Maker: The Incredible Career of Samuel Colt* (New York: Harper & Brothers, 1935), 34-35. Colt used the money he earned as an itinerant nitrous oxide exhibitor to fund his famous revolver.

shows" that were becoming popular in antebellum America.[174] The primary difference was that instead of reinforcing a sense of normality through the exhibition of physical anomalies, nitrous oxide demonstrations served to exhibit psychological anomalies. These anomalies were all the more interesting since they came from individuals within the local community itself, rather than imported from outside of the localities like visiting physical freaks.

Irrational behaviors and subjective sensations due to emotional fluctuations were also understood as comparable to being under the influence of nitrous oxide. In the following instance, the author describes what is known about nitrous oxide in the mid-1820s while in the process of comparing it to the emotional experience of love:

> Can it [love] be compared with the exhilarating or nitrous oxide gas? To unassisted vision love is imperceptible. It certainly is very diffusible, though not a paramount stimulus. I would not wish to be understood that love emanates from the same source from which this gas is usually respired in Chemical Laboratories; but that its effects are somewhat the same as those subjected to its influence. Some immediately upon its action are wrapped in a mantle (though by no means an enviable one) of sedate silent reverie. Others, while breathing this indescribable something, if any difference or difficulty arises, either *pugnant, pugnas, pugnis*, or with canes, horse-whips or the like--and occasionally those are heard of who are honorably foolish, who imbibe the spirit of the times--who pattern after the *great men*, national men, and decide their disputes, secundum artem, in real Hoboken style.[175]

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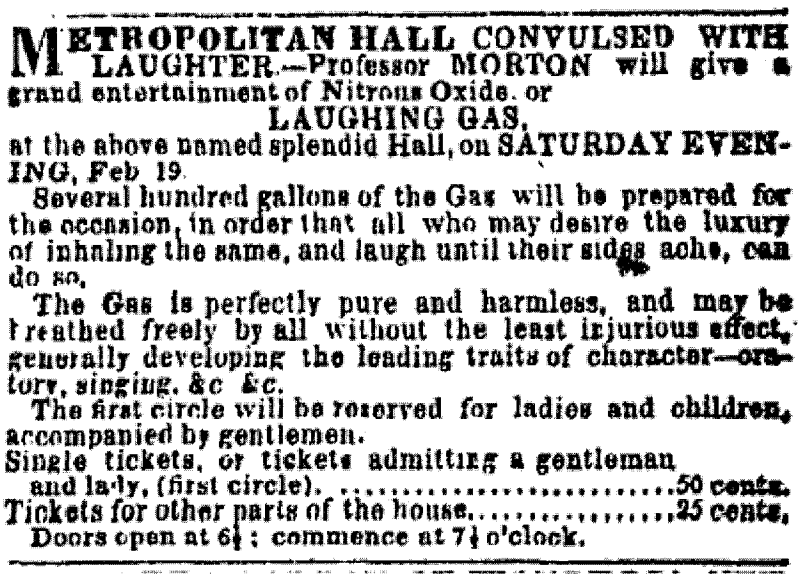
[174] Ellen Hickey Grayson, "Social Order and Psychological Disorder: Laughing Gas Demonstrations, 1800-1850," in *Freakery: Cultural Spectacles of the Extraordinary Body*, ed. Rosemarie Garland Thomson (New York: NYU Press, 1996), 109.

[175] Nil Admirari, "Fine Feeling," *The New - York Mirror: a Weekly gazette of literature and fine arts* 2, no. 29 (1825): 230.

Love brings out the true nature of the individual, just as nitrous oxide brings to the fore those aspects of the psyche that are often and under normal circumstances concealed. Nitrous oxide again is considered to be a stimulant, unlike the feelings of love. Just as love could bring out the best or worst qualities in an individual, so did nitrous oxide.

Capitalizing on the fame of William Morton's ether experiments in Boston in the mid-1840s, an individual claiming to be "Professor Morton" gave a series of demonstrations of nitrous oxide in New York City in 1853.



METROPOLITAN HALL CONVULSED WITH LAUGHTER.—Professor MORTON will give a grand entertainment of Nitrous Oxide, or
LAUGHING GAS,
at the above named splendid Hall, on SATURDAY EVENING, Feb 19.
Several hundred gallons of the Gas will be prepared for the occasion, in order that all who may desire the luxury of inhaling the same, and laugh until their sides ache, can do so.
The Gas is perfectly pure and harmless, and may be breathed freely by all without the least injurious effect, generally developing the leading traits of character—oratory, singing, &c &c.
The first circle will be reserved for ladies and children, accompanied by gentlemen.
Single tickets, or tickets admitting a gentleman and lady, (first circle).....50 cents.
Tickets for other parts of the house.....25 cents.
Doors open at 6½; commence at 7½ o'clock.

Figure 8. Professor Morton presents Laughing Gas at the Metropolitan Hall. Classified advertisement *New York Times* 12 February 1853 p. 3.

In a show of post-Jacksonian egalitarianism, Morton placed less emphasis on the class of his clientele than he did on the pleasure afforded by inhaling the gas. Morton also emphasized that the effects of the gas were a way to reveal the underlying character of the individuals partaking it on stage, claiming that the gas was "...developing the leading traits of character." Even into the early 1850s, nitrous oxide was seen as a window into the soul.

Another author explicitly makes reference to the antebellum problem of concealing one's true character when comparing nitrous oxide inhalation to a sudden surprise.

> A good fright acts like laughing gas [nitrous oxide] in developing unexpected, and sometimes studiously concealed traits of character, and it is curious to witness the operation upon persons of different temperaments.[176]

In this circumstance nitrous oxide is understood as a truth serum of sorts, under the influence of which it might be impossible to conceal one's hidden inclinations. Like a good fright, the gas affected the system in such as way as to break down any façades that the inhaler had constructed in order to advance socially. It revealed the true self.

By the 1840s, nitrous oxide exhibitions were firmly established as a new cultural product serving the purpose of demarcating between appearance and reality. The exhibitions managed to "...delineate the parameters of middle-class respectability..." by making the hidden manifest.[177] Nitrous oxide was well known outside of medical and scientific circles, used as a catalyst for amusement and in the process served as a method of determining the real character of an individual. Nitrous oxide was popularly used as a tool to determine character in a time when outward appearances and inner aspects were not necessarily linked.

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[176] Jennie June, "Jennie June's Letters," *The United States Democratic Review*, Jun 1858, 469.

[177] Ellen Hickey Grayson, "Social Order and Psychological Disorder: Laughing Gas Demonstrations, 1800-1850," in *Freakery: Cultural Spectacles of the Extraordinary Body*, ed. Rosemarie Garland Thomson (New York: NYU Press, 1996), 118.

Gardner Quincy Colton and P. T Barnum

Gardner Quincy Colton was the most famous nitrous oxide exhibitor of the Nineteenth-Century. Colton had studied medicine in New York City under Dr. Willard Packard before he went into the exhibition business in 1844.[178] He gave a series of laughing gas demonstrations throughout the mid-1840s which assured his popularity by emphasizing his gentlemanly authority and demeanor. He was famous and well-respected throughout New York City and its outlying localities.

> His [Colton's] social, free, and gentlemanly bearing, his perfect understanding of the subject of which he treats, together with the amusement afforded by his 'laughing gas' have made him decidedly the most popular lecturer we Hudsonians have been favored with for many years.[179]

Colton tended to emphasize two contradictory aspects of his demonstrations: the fact that these exhibitions were safe and moral entertainments, alongside the idea that he would be presenting, with the help of the gas, social and psychological freaks from within the community. He learned to target different audiences at different times to insure the propriety of his events. He geared certain entertainments specifically to the fairer sex. These small parties were set up to make ladies feel comfortable inhaling the gas for the first time, and additionally helped Colton to find the most interesting subjects for his larger exhibitions.

> Mr. Colton will have the honor to give a FREE lecture and Exhibition to the Ladies at Clinton Hall (Corner of Beekman and Nassau sts.) Friday afternoon, commencing precisely at 3 o'clock.

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[178] Laird W Nevius, *The Discovery of Modern Anaesthesia: By Whom Was It Made? A Brief Statement of Facts* (New York City: George W. Nevius, Cooper Institute, 1894), 93.

[179] "Classified Advertisement," *New York Tribune* December 19, 1845, 2.

> Mr. C. will treat the subject of the *Nitrous Oxide* or *Laughing Gas* in a scientific manner, and endeavor to make it *instructive* as well as amusing. A number of Ladies will inhale the Gas after the lecture. He solicits the attendance of the same class of Ladies that have patronized his former efforts.[180]

Colton advertised his exhibitions as educational and scientific, distancing himself from the baser theatrical amusements which ladies tended to shy away from during the 1840s. This advertisement from the *Brooklyn Daily Eagle* focused on the fact that ladies only were going to partake of the gas, while still attempting to categorize the entertainment as appropriate for the upper classes, "the first people of Brooklyn."

GREAT ATTRACTION!

☞ Mr. COLTON will give his closing entertainment of Nitrous Oxide, or LAUGHING GAS, at the Brooklyn Lyceum, FRIDAY eve'g, Feb. 28.

Mr. C has the pleasure to announce that on this occasion 10 Gentlemen and 15 Ladies will inhale the Gas!

The Ladies have been consulted upon the subject, and have given an unqualified consent to inhale the Gas on this occasion. Probably more than the number stated will inhale it.

To those who know, or have heard anything of the entertainments given exclusively to ladies, it is unnecessary to urge the attraction or interest of this. Those who love an evening's intense amusement, are invited to attend.

Mr. C. pledges himself to fulfil the above to the letter.

He has endeavored to conduct his entertainments in such a manner as to meet the approbation and patronage of the first people of Brooklyn, and he has the authority of Mr. Walters, principal director of the Institute, for saying that they have been patronised by that class.

Figure 9. G. Q. Colton's Laughing Gas entertainment at the Brooklyn Lyceum. Classified advertisement *Brooklyn Daily Eagle* 27 February 1845

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[180] "Classified Advertisement," *New York Tribune* December 19, 1845, 3.

The moral status of nitrous oxide events became more important as their frequency increased. Colton was especially adept at promoting the respectability of his shows in contrast to those of his competitors:

> Mr. Colton would say in regard to the Laughing Gas entertainments which have been given of late in this city, that his only regret is that *he* and *his* may be judged by them. Those who have seen those entertainments, do not know what a *Laughing Gas* Entertainment is.[181]

Colton not only promoted the uniquely moral aspects of his entertainments, he appealed to the vanity of his potential audience as well, implying that his exhibitions attract a higher class of amusement seekers than other baser entertainments.

> Mr. C.'s entertainments of the same character, in Brooklyn, have been attended by the most respectable people, and he believes they met with universal approbation.[182]

It was important that Colton's audience understand that they were part of a moral and intellectual elite, one that would be subject to the oddities exhibited by lesser individuals whose nature would be revealed by the gas. The fact that these lesser individuals were from within the community made the events all the more enticing. Yet rather than focusing on the baser pleasures derived from watching one's fellow man come psychologically undone in public, Colton tried to emphasize that his clientele would walk away from the event with new and useful knowledge.

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[181] "Classified Advertisement," *New York Tribune* December 28, 1844, 3.

[182] "Classified Advertisement," *New York Tribune* March 15, 1845, 3.

Colton also exploited the prevalent idea that nitrous oxide would bring out the true inner character. In his advertisement for a nitrous oxide exhibition in 1844, Colton emphasized just how strongly the link between exposing the prominent features of character and inhalation of the gas had become. In this case, Colton was producing one of his small gatherings for select ladies. A young woman who had recently been preoccupied with religious ideas took her turn inhaling the gas.

> At a private party a few evenings since, a young lady inhaled the Gas, whose mind had recently been powerfully exercised upon the subject of religion. Immediately after inhaling the Gas, her eyes closed, and she rose and began to dance and hop about the room, clapping her hands, and exclaiming, in a subdued tone, "Oh how happy !--oh, how happy !--if they *would* but listen, if they *would* but repent !" &c.--showing evidently the state of her mind and feelings. This continued for about fifteen minutes, and when she came to herself she said she had never been so happy in all her life, and was perfectly willing to inhale the Gas again. This was an uncommon case, but it proves that the prominent feature of a person's character is brought out.[183]

In addition to portraying yet another example of how nitrous oxide was believed to bring to the fore the prominent aspects of character, this advertisement also emphasized that even the most moral and trustworthy ladies were partaking of the gas. With her preoccupation with religious ideas, this aforementioned young lady was Colton's perfect example of a genteel audience participant.

Colton may have focused on the propriety of his events, but he still was expected to keep his audience laughing. Another reason that he auditioned individuals in "private entertainments"

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[183] "Classified Advertisement," *New York Tribune* December 28, 1844, 3.

was for the purpose of finding the most unusual and interesting oddities to display at his Annual Exhibitions. These included the odd, queer, peculiar and eccentric.

> The entertainment will commence with a *GRAND VOLUNTARY ON THE ORGAN*, By Mr. TIMM, who is engaged for the occasion. After which NINETY GALLONS of GAS having been prepared, will be administered to THIRTY-FIVE gentlemen. These gentlemen have been selected from over ONE HUNDRED who have inhaled the Gas at private entertainments, and the combine a company of the most
>
> Intellectual, Eccentric, Original,
> Peculiar, Odd, Queer,
> and Laughable
>
> Character that the City affords. Six of them are worth the price of admission to witness. The private entertainments were given on purpose for this selection.
>
> A strong Stage and Railing will be erected for a protection to the persons under the influence of the Gas, and that the audience may have a good opportunity to witness the performance.
>
> Twelve strong men will stand around and upon the stage, as a safeguard against all danger either to the audience or the person under the influence of the Gas.[184]

His audience in New York City for this particular exhibition was standing-room only, packing in between three and four thousand of the town's citizens.[185] Colton's lecture exhibitions continued for a variety of audiences around New England until the middle of 1846. He continued traveling the country until 1849, presenting nitrous oxide in cities across the young nation.

The most famous of all the Nineteenth-Century museum proprietors, P. T. Barnum, was also willing to use nitrous oxide as an attraction that promoted the freakish psyches of his fellow man. Never one to miss out on an attraction, on Monday 11 November 1844, Barnum began advertising Laughing Gas as a feature of his American Museum in New York City:

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[184] "Classified Advertisement," *New York Tribune* December 28, 1844, 3.

[185] G. P. Morris and N. P. Willis, "Diary of Town Trifles," *The New Mirror*, April 6 1844, 8-9.

> LAUGHING GAS
> Will be administered at each performance, and all its Mirthful Influences exhibited, for the first time at this establishment.[186]

This advertisement ran until 15 November. On 18 November, a new advertisement appeared, specifically mentioning the unusual and freakish behavior caused by the gas.

> LAUGHING GAS.--This most amusing exhibition will be given at each performance, and its ludicrous effects will be manifested in the most unique speeches, songs, gestures, &c.[187]

The last ad for laughing Gas at the American Museum was on 28 November, 1844 simply read, "Laughing Gas, With its Mirthful and Ludicrous Effects."[188] The American Museum did not advertise Laughing Gas again until 6 March 1845, when the advertisement was again simple: "LAUGHING GAS, by a learned Chemist."[189] At this point it appears that Barnum gave up using nitrous oxide at the museum. One possible reason could have been the comparative success of his acquaintance Colton, who was packing hundreds into lecture halls in the New York City area for his exhibitions during this period, competing directly with Broadway's American Museum.

In this chapter we have examined a wide range of ways that nitrous oxide was used in the first half of the Nineteenth-Century. Not only do we find that nitrous oxide enjoyed widespread popularity, but that knowledge about the gas did undergo some changes during this period. Whereas at the beginning of the Nineteenth-Century nitrous oxide was known by the subjective sensations it produced in the individual, that knowledge was soon overshadowed by its role as a

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[186] "Classified Advertisement," *New York Tribune* November 11, 1844, 3.

[187] "Classified Advertisement," *New York Tribune* November 18, 1844, 3.

[188] "Classified Advertisement," *New York Tribune* November 27, 1844, 3.

[189] "Classified Advertisement," *New York Tribune* March 6, 1845, 3.

catalyst of unpredictable behavior. Later, it became a tool that could be used to garner the true character of others at a time when such information was difficult to ascertain. Moreover, nitrous oxide became throughout the first half of the Nineteenth-Century a public substance, functioning as a glue which held together social relations in an unstable society.

Chapter 4. Anesthesia

In chapter 2, we explored the early uses of nitrous oxide and learned how its unpredictable ways of affecting people ran counter to Humphry Davy's goals for scientific demonstration. Chapter 3, meanwhile, showed how nitrous oxide was used extensively during the first half of the Nineteenth-Century, and how its very unpredictability became an asset in the context of entertainment. Now that we understand the uses of nitrous oxide around the time of Wells and Morton's demonstrations, we are ready to examine these demonstrations in greater detail.

It is no great revelation to claim that Horace Wells stumbled upon the idea of using nitrous oxide to quell pain from a popular lecture on the gas. Historians over the past 150 years have chronicled this fact.[190] However, the extent to which the cultural presence of nitrous oxide

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[190] Cf. American Dental Association. Horace Wells Centenary Committee., *Horace Wells, Dentist, Father of Surgical Anesthesia; Proceedings of Centenary Commemorations of Wells' Discovery in 1844, and Lists of Wells Memorabilia, Including Bibliographies, Memorials and Testimonials* ([Chicago]: American Dental Association, Horace Wells Centenary Committee, 1948), W. Harry Archer, Milton Baron Asbell, and William B. Irby, *The History of the Development of Anesthesia, Oral Surgery and Hospital Dental Service in the United States of America. [by] Archer, Asbell [and] Irby* ([Pittsburgh, Pa.]: 1971), Santiago Colás, "Anesthetics Vs Anaesthetic: How Laughing Gas Got Serious," *Science as culture* 7, no. 3 (1998): 335-353, Julie M. Fenster, *Ether Day: The Strange Tale of America's Greatest Medical Discovery and the Haunted Men Who Made It*, 1st ed. (New York: HarperCollins, 2001), Richard B. Gunderman, "Dr. Horace Wells and the Conquest of Surgical Pain: A Promethean Tale," *Perspectives in Biology and Medicine* 35 (1992): 531-548, Thomas Edward Keys, *The History of Surgical Anesthesia. With an Introductory Essay by Chauncey D. Leake, a Concluding Chapter, the Future of Anaesthesia,*

influenced the acceptance of Wells' ideas has been ignored in the historical literature. By situating Wells' and Morton's anaesthetic demonstrations within a larger cultural context, one which includes the prevalent use of nitrous oxide for entertainment and acquiring social knowledge, we find that the so-called mystery behind Well's failure at Massachusetts General Hospital, and Morton's consequent success at the same location, dissipates into thin air.

In this chapter I first outline Wells' failed demonstration, and then look at Morton's successful one, cataloging the general similarities and differences between the two demonstrations in preparation for the more detailed historiographical analysis of Chapter 6. The intent is to privilege neither the social nor the material aspects of these demonstrations, but to emphasize their similarities while pointing out the critical differences that emerge when the cultural importance of nitrous oxide is taken into consideration.

[New ed. (New York: Dover Publications, 1963), 10, Leonard F. Menczer and Richard J. Wolfe, eds., *I Awaken to Glory: Essays Celebrating the Sesquicentennial of the Discovery of Anesthesia by Horace Wells, December 11, 1844-December 11, 1994* (Boston, MA: Boston Medical Library in the Francis A. Countway Library of Medicine Boston in association with the Historical Museum of Medicine and Dentistry Hartford, 1994), Howard Riley Raper, *Man against Pain; the Epic of Anesthesia* (New York: Prentice-Hall, 1945), W. D. A. Smith, *Under the Influence: A History of Nitrous Oxide and Oxygen Anaesthesia* (London: Macmillan Publishers, 1982), A. J. Wright, "History of Anesthesia: Early Use of Nitrous Oxide," *Bull Anesth Hist* 17, no. 3 (1999): 10-11.

The failed demonstration

Figure 10. Horace Wells portrait in James McManus Notes on the History of Anaesthesia. (Hartford: Clark & Smith, 1896). Frontispiece.

By December 1844, Colton had successfully exhibited nitrous oxide in New York City, and was touring New England demonstrating the gas. Colton never strayed too far from the east coast during this period, but in December of 1844 decided to visit the small town of

Hartford, Connecticut. Colton advertised in the 10 December 1844 Hartford *Daily Courant* that he would be exhibiting nitrous oxide at the Union Hall.

> A GRAND EXHIBITION of the effects produced by inhaling NITROUS OXIDE, EXHILARATING or LAUGHING GAS! will be given at UNION HALL THIS (Tuesday) EVENING, Dec. 10, 1844... He believes he can make [gentlemen] laugh more than they have in six months previous. The entertainment is *scientific* to those who *make* it scientific.[191]

Colton stressed the genteel and intellectual merit of his lectures, as well the scientific and educational aspects of these events. Although demonstrations of nitrous oxide were popular social events in the mid-1840s, as we have seen, Colton wanted his lectures to stand out as both entertaining and informative.

December 10 was a typical nitrous oxide lecture and exhibition. Colton rented Union Hall in Harford, and scheduled the event for 7 o'clock in the evening. Colton began the evening by giving a short lecture on the nature and properties of nitrous oxide, emphasizing how it revealed the true character of the inhaler.[192] He then administered to himself the first dose of the evening, reciting Shakespeare while under the influence of the gas in his attempt to convince the audience that the gas was harmless.[193] After this initial demonstration, volunteers rushed to the

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[191] "Classified Advertisement," *Daily Courant* December 10, 1844, 5. Emphasis in original.

[192] Colton may have demonstrated as part of his exhibition how to produce nitrous oxide, but primary sources are vague on this possibility. For secondary source treatments, cf. Julie M. Fenster, *Ether Day: The Strange Tale of America's Greatest Medical Discovery and the Haunted Men Who Made It*, 1st ed. (New York: HarperCollins, 2001), 51.

[193] It is interesting the Colton chose to recite Shakespeare. At this point during the Nineteenth-Century, the work of Shakespeare transcended cultural boundaries, and was not considered to be elitist, but was popular entertainment. This emphasizes that Colton was appealing to a variety of classes with his

stage for the chance to inhale the gas.[194] Colton recalled how Wells approached the stage along with local chemist Samuel Cooley.

> After a brief lecture on the properties and effects of the gas, I invited a dozen or fifteen gentlemen to come up on the stage who would like to inhale it. Among those who came forward was Dr. Horace Wells, a dentist of Hartford, and a young man by the name of [Samuel A.] Cooley.[195]

Cooley turned out to be an ideal participant. His reaction to the gas was lively and must have been amusing to Colton's audience. He apparently smashed his leg into a wooden bench while frolicking on the platform under the influence of the gas. Wells also partook of the gas at about the same time in the evening as Cooley. He was struck by the way that Cooley was able to "dance and dash" after hurting himself.[196] Wells was also surprised that Cooley expressed no indication of being in pain upon injuring himself while under the influence of the gas, and Wells questioned him about his sensations once both men had returned to their seats.

> Cooley inhaled the gas, and while under its influences ran against some wooden settees on the stage, and bruised his legs badly. On taking his seat next to Dr. Wells, the latter said to him, 'You must

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demonstrations. Cf. Lawrence Levine, "William Shakespeare and the American People: A Study in Cultural Transformation," *American Historical Review* 89, no. 1 (1984): 34-66, Lawrence W. Levine, *Highbrow/Lowbrow: The Emergence of Cultural Hierarchy in America* (Cambridge, MA: Harvard University Press, 1988).

[194] Henry Wood Erving, "The Discoverer of Anaesthesia: Dr. Horace Wells of Hartford," *Yale Journal of Biology & Medicine* 5, no. 5 (1933): 425.

[195] Gardner Quincy Colton, *A True History of the Discovery of Anaesthesia : A Reply to Elizabeth Whitman Morton* (New York: A.G. Sherwood, 1896), 4.

[196] Gardner Quincy Colton, "Wells Memorial Celebration: Prof. Gardner Q. Colton, of New York," in *Notes on the History of Anesthesia, the Wells Memorial Celebration Early Record of Dentists in Connecticut*, ed. James McManus (Hartford, CT: Clark & Smith, 1896), 36.

> have hurt yourself," "No." Then he began to feel some pain, and was astonished to find his legs bloody; he said he felt no pain until the effect of the gas had passed off.[197]

It was at this point that Wells made the connection between the excited state induced by the gas and insensibility to pain. He turned to a nearby friend, David Clark, and mused on the potential use of the gas in surgery. Wells believed that with nitrous oxide it might be possible to extract a tooth or even amputate a limb without the patient experiencing any pain.[198]

After the show, Wells approached Colton to ask him if he thought that a man could have a tooth extracted under the influence of gas. When Colton replied that he did not know, Wells asked Colton to bring the gas to his dental office for an experiment the following day. Wells explained his ideas about pain free surgery, and convinced Colton to come to Wells' office the following morning and administer the gas. Wells had a molar which was diseased, and decided that he himself would be the subject of this first medical trial.

Wells, believing that the gas was a stimulant, thought that its exciting properties might be used to make a patient oblivious to surgical pain.

> Reasoning from analogy, I was led to believe that surgical operations might be performed without pain, by the fact that an individual, when much excited from ordinary causes, may receive severe wounds without manifesting the least pain; as, for instance, the man who is engaged in combat may have a limb severed from his body, after which he testifies that it was attended with no pain at the time; and so the man who is intoxicated with spirituous liquor may be treated severely without manifesting his pain, and his frame, in this state, seems to be more tenacious of than under

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[197] Gardner Quincy Colton, *A True History of the Discovery of Anaesthesia : A Reply to Elizabeth Whitman Morton* (New York: A.G. Sherwood, 1896), 4.

[198] James McManus, *Notes on the History of Anaesthesia : The Wells Memorial Celebration at Hartford, 1894: Early Record of Dentists in Connecticut* (Hartford: Clark & Smith, 1896), 6.

> ordinary circumstances. By these facts I was led to inquire if the same result would not follow, by the inhalation of some exhilarating gas, the effect of which would pass off immediately, leaving the system one the worse off for its use.[199]

Nitrous oxide had an advantage over most stimulants: it was not followed by the depressive phase, and for Wells this was one of the key reasons it might be of some use in surgery. If a man might be brought to the phase of excitation without the consequent depression, the pain of surgery could be avoided, as well as the dangers immanent in adding a physical depression of the body to the shock of surgery.

Wells had been interested in finding a way to relieve surgical pain for years before Colton's show in Hartford. As early as 1840, he conversed with his friend Dr. Linus P. Brockett about the idea of painless surgery.[200] In the early 1840s, he experimented with mesmerism, a popular yet controversial technique used at the time to prevent surgical pain.[201] Mesmerism was however impractical; it required not only an indefinite amount of time to take effect, but a close rapport between mesmerist and subject was a necessary component of the process that was difficult to obtain in a clinical setting. When nitrous oxide presented itself to Wells as a potential candidate to quell surgical pain, Wells immediately took action, setting up the morning trial.

On the evening of 10 December 1844, after the show at Union Hall, Wells called upon his associate Dr. John Riggs for a late night discussion. Wells told Riggs of his plan to try the gas

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[199] Horace Wells, "Original Discoverer of the Application of Etherization to Surgery," *Lancet* 49, no. 1235 (1847): 471.

[200] James McManus, *Notes on the History of Anaesthesia : The Wells Memorial Celebration at Hartford, 1894: Early Record of Dentists in Connecticut* (Hartford: Clark & Smith, 1896), 5.

[201] Alison Winter, *Mesmerized : Powers of Mind in Victorian Britain* (Chicago: University of Chicago Press, 1998).

on himself the following morning, but he needed someone to perform the operation. Wells asked Riggs to perform the tooth extraction, which would be one of Wells' upper molars. Riggs had reservations about Wells decision to try the gas on himself.[202] Even though Wells had already inhaled nitrous oxide at Colton's show with no ill effects, taking it prior to a molar extraction did pose new dangers. Since nitrous oxide was understood to be a stimulant and had a reputation of exciting the system, there was the distinct possibility that under the influence of the gas Wells would be difficult to physically control. Riggs was concerned that Wells was placing himself in unfathomable danger. He was also concerned over how much gas to administer, and what the effects would be on Wells.

> No one but Wells and myself knew to what point the inhalation was to be carried. The result was painfully problematical to us.[203]

Wells assured Riggs that he had experienced no ill effects from the nitrous oxide at Colton's demonstration, and that the experiment itself presented limited danger. The private experiment was scheduled for the morning of 11 December 1844. Riggs would extract the tooth.

Colton brought his equipment to Wells' office and produced a batch of nitrous oxide. In addition to Colton and Wells, the cramped office contained Riggs, who was to perform the extraction on Wells, Samuel Cooley, and C. F. Colton, who had been traveling with Colton's show. The office door was left ajar, so that the observers could escape if Wells suddenly became

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[202] James McManus, *Notes on the History of Anaesthesia : The Wells Memorial Celebration at Hartford, 1894: Early Record of Dentists in Connecticut* (Hartford: Clark & Smith, 1896), 7.

[203] Riggs quoted in Howard Riley Raper, *Man against Pain; the Epic of Anesthesia* (New York: Prentice-Hall, 1945), 75.

violent under the gas. Colton administered the nitrous oxide. Concern over mania was soon dispelled as Wells' head lolled back like that of a rag doll and Riggs pulled the tooth.

> I then obtained some nitrous oxide gas and requested Dr. J. M. Riggs to perform the operation at the moment when I should give the signal, resolving to have the tooth extracted before losing all consciousness. This experiment proved to be entirely successful--it was attended with no pain whatsoever.[204]

The witnesses were stunned at Wells' insensibility. Instead of inducing the mania and high spirits typical of the public nitrous oxide demonstrations, the gas rendered Wells passive and insensible. Riggs recalled:

> You may ask, 'Why did he not get up?' Simply because he could not! Our agreement was to push the administration to a point hitherto unknown. We knew not whether death or success confronted us. It was terra incognita we were bound to explore.[205]

Wells was apparently thrilled with the results, claiming upon returning to his senses, "I did not feel so much as the prick of a pin."[206] He immediately asked Colton to instruct him in the production of the gas, and Colton willingly obliged. He then obtained the equipment to produce his own supply of nitrous oxide and worked for the next several weeks perfecting the methodologies necessary to create a mixture of the gas that would be most suitable for deadening

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[204] Wells quoted in W. Harry Archer, "Life and Letters of Horace Wells, Discoverer of Anesthesia, Chronologically Arranged, with an Appendix.," *Journal of the American College of Dentists* 11, no. 2 (1944): 119-120.

[205] Riggs quoted in Howard Riley Raper, *Man against Pain; the Epic of Anesthesia* (New York: Prentice-Hall, 1945), 75.

[206] Gardner Quincy Colton, "Wells Memorial Celebration: Prof. Gardner Q. Colton, of New York," in *Notes on the History of Anesthesia, the Wells Memorial Celebration Early Record of Dentists in Connecticut*, ed. James McManus (Hartford, CT: Clark & Smith, 1896), 36.

pain during dental surgery. As a series of informal trials, Wells and Riggs decided to use the gas in their practice during January of 1845.

Encouraged by initially positive results, Wells contacted some acquaintances in Boston. His goal was to bring this new discovery to the attention of the greater medical community. Since Wells had spent some time in Boston in a brief dental partnership with his former student William Thomas Green Morton, he chose the New England metropolis for his arena of demonstration, and enlisted Morton's support. Wells traveled to Boston in mid-January 1845, and met with Morton and their mutual acquaintance, apothecary Dr. Charles T. Jackson.[207] Morton had contacts at the Massachusetts General Hospital, and Wells asked that Morton help him to set up a public demonstration showing the efficacy of nitrous oxide in surgery.

Wells was initially met with resistance against using nitrous oxide, a stimulant, to quell pain during surgical procedures. Wells' idea went against medicine as it was then understood. An over-stimulated patient would hardly be insensible, and offers the additional problem of trying to keep the patient still and controlled during surgery. When Wells told them of his findings, Morton was suspicious, and Jackson mocked Wells outright.[208] To apply a stimulant to an individual predisposed towards chaotic behavior seemed absurd to those Wells confided in. After much convincing to at least allow him the chance to prove his theory, Morton, who was

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[207] W. D. A. Smith, *Under the Influence: A History of Nitrous Oxide and Oxygen Anaesthesia* (London: Macmillan Publishers, 1982), 57. Wells and Morton had joined in a short lived partnership making false teeth at 19 Tremont Row in Boston that lasted less than a month during January of 1844.

[208] Gardner Quincy Colton, "Wells Memorial Celebration: Prof. Gardner Q. Colton, of New York," in *Notes on the History of Anesthesia, the Wells Memorial Celebration Early Record of Dentists in Connecticut*, ed. James McManus (Hartford, CT: Clark & Smith, 1896), 37.

taking a few medical courses, reluctantly arranged for Wells to demonstrate his gas during a major surgery at Massachusetts General Hospital.

The scheduled operation was a limb amputation.[209] The locations was to be the surgical dome at the Massachusetts General Hospital and the lead surgeon was Dr. George Hayward, who was eventually to be promoted to head surgeon at the hospital. The opportunity to assist Hayward in this context would have been an honor and a privilege for Wells, allowing him the opportunity to demonstrate his new principle of painless surgery in a prestigious context, one including both enthusiastic medical students and successful professional surgeons. However, as was often the case, the amputee feared the knife, and the surgery was repeatedly postponed. As the promised surgery failed to materialize, Wells grew impatient to demonstrate the nitrous oxide. In his impatience, Wells proposed a change in venue which would allow him to demonstrate painless surgery using nitrous oxide right away.

> I was then invited to administer it [nitrous oxide] to one of the patients, who was expected to have a limb amputated. I remained some two or three days in Boston for this purpose, but the patient decided not to have the operation performed at that time. It was then I proposed that I should administer it to an individual for the purpose of extracting a tooth. Accordingly, a large number of students, with several physicians met to see the operation performed--one of their number was to be the patient.[210]

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[209] Surgeries during the Nineteenth-Century were performances. "Operating day was a weekly show with celebrities performing before colleagues, students and the public at large." Roy Porter, *The Greatest Benefit to Mankind : A Medical History of Humanity*, 1st American ed. (New York: W. W. Norton, 1997), 360.

[210] Horace Wells, *A History of the Discovery of the Application of Nitrous Oxide Gas, Ether, and Other Vapors, to Surgical Operations* (Hartford: J. Gaylord Wells, 1847), 6.

Circumstances worked against Wells. Whereas a major surgical operation performed by a prestigious surgeon was an ideal arena in which Wells could demonstrate the utility of nitrous oxide, extracting a tooth in front of a bunch of students was not going to enhance Wells' medical credibility. In lieu of an amputation in the dome, Dr. John Collins Warren, current head of surgery at Massachusetts General Hospital, offered Wells the opportunity to speak to his medical students after one of his lectures on surgery.

> At last he went to Cambridge College, and the elder Dr. Warren, at the close of his lecture on surgery, said to the class, "There is a gentleman here who pretends to have something which will destroy pain in surgical operations. He wants to address you. If any of you would like to hear him, you are at liberty to do so." (One of the class told me this.) Quite a number did remain.[211]

Warren's opening remarks did little to bolster Wells' credibility.[212] After this half-hearted introduction, Wells and about half of the students attending Warren's lecture moved to another classroom, a hall on Washington Street, for the demonstration. This simple change of location further served to separate Wells from the prestige and authority linked with the surgeon Warren.

The apparatus Wells was using to administer the gas was familiar to all present. Wells had stored his nitrous oxide gas in an oiled silk bag fitted with a stop-cock: the same piece of

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[211] Gardner Quincy Colton, *A True History of the Discovery of Anaesthesia : A Reply to Elizabeth Whitman Morton* (New York: A.G. Sherwood, 1896), 5.

[212] It is unclear from the historical documents whether Warren attended this demonstration or not. He made no remarks about witnessing Wells' initial demonstration when writing about his first experiences with anesthesia. My judgment is that he left after the introduction, when the party moved to the other classroom. Cf. John Collins Warren, *Etherization: With Surgical Remarks* (Boston: William D. Ticknor & Company, 1848).

equipment used to administer various gases for over forty years.[213] William Pepys had introduced the gas-bag in 1802, and few modifications had been made since its introduction.[214] Wells used the same type of equipment that Colton had demonstrated to him a month earlier, and this was the same equipment that was used at the popular nitrous oxide demonstrations. The gathered students must have immediately recognized this common bit of pneumatic apparatus, likely from their own "experiments" with nitrous oxide that were often undertaken after chemistry and medical lectures. Thus instead of administering nitrous oxide prior to a skilled surgical procedure, Wells ended up giving a boy some exhilarating gas prior to a tooth extraction. Things did not go as smoothly as Wells had hoped.

> Well, one of the class told me that about one-half of the class did remain and at the close of his remarks he [Wells] gave the gas to one of the boys. The boy hollered out, *although he said that he did not feel any pain*, but the students considered it a failure and they hissed and hurt the feelings of Dr. Wells.[215]

Apparently when Wells extracted the tooth, his patient made some kind of outcry. Daniel T. Curtis witnessed Wells' demonstration. His account of the events highlights the extent to which the results of this demonstration were open to negotiation, as even Curtis did not seem to blame Wells as much for the failure as Wells did.

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[213] Horace Wells, *A History of the Discovery of the Application of Nitrous Oxide Gas, Ether, and Other Vapors, to Surgical Operations* (Hartford: J. Gaylord Wells, 1847), 4.

[214] William H. Pepys, "Description of a New Gas-Holder.," *Tilloch's Philosophical Magazine* 13 (1802): 153.

[215] Gardner Quincy Colton, "Wells Memorial Celebration: Prof. Gardner Q. Colton, of New York," in *Notes on the History of Anesthesia, the Wells Memorial Celebration Early Record of Dentists in Connecticut*, ed. James McManus (Hartford, CT: Clark & Smith, 1896), 37. Emphasis in original.

> The gas was administered, and the tooth extracted under its influence by the said Wells, in the presence of myself and many others. I am not able to say whether the patient experienced any pain or not. There was certainly no manifestation of it, yet some present expressed themselves in the belief that it was an imposition.[216]

There was not sufficient evidence at the time to say conclusively and based only on the events whether the demonstration was a success or failure. It was the student witnesses who decided whether the demonstration succeeded. Even though the individual claimed that he felt no pain, his outcry was all that was needed in the minds of the majority of witnesses to condemn the effort.

Morton's recollection of the events reveals yet another layer of uncertainty to the display. He recalls that the students that stayed behind after Warren's lecture were there not only to see Wells' demonstration, but to inhale nitrous oxide for fun.

> I readily consented, and introduced him to Dr. George Hayward, an eminent surgeon, who offered to permit the experiment but as the earliest operation was not to be performed under two or three days, we did not wait for it, but went to Dr. Warren, whom we found engaged with his class. He told us that his students were preparing to inhale it that evening, for sport, and offered to announce a proposal to them, and ask them to meet us at the college. In the evening Dr. Wells and I went to the hall, and I took my instruments. Dr. Wells administered the gas, and extracted a tooth, but the patient screamed from pain, and the spectators laughed and hissed. The meeting broke up, and we were looked upon as having made ourselves very ridiculous.[217]

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[216] Curtis quoted in Horace Wells, *A History of the Discovery of the Application of Nitrous Oxide Gas, Ether, and Other Vapors, to Surgical Operations* (Hartford: J. Gaylord Wells, 1847), 15.

[217] William Morton quoted in Richard H. Dana, "A History of the Ether Discovery. Report of the Massachusetts General Hospital," *Littell's Living Age*, no. 201 (1848): 567.

Morton's recollection clarifies the extent to which social circumstances attributed to Wells' failure. Morton recalled how the students were already planning a gathering for the recreational use of nitrous oxide. The fact that his witnesses were already prepared to use the substance that Wells claimed had serious surgical use in a frivolous context only worked against Wells' attempt to re-categorize the substance as a tool in surgical procedures.

As Morton and others have stated, Wells' demonstration was branded not just a failure, but an abysmal one. Wells was called a charlatan and a humbug by those present at his demonstration.[218] He was not permitted a second trial.[219] Wells gathered his equipment and left in utter dejection, all the while attributing to himself a lack of skill for failing to impress the medical elite. He believed that he had erred in the administration of the gas, not giving enough to render his patient insensible.[220] One can see how Wells' authority was undermined by reports of his failed demonstration. Dr. Henry Jacob Bigelow, a man who would turn out to be one of the most vocal supporters of Morton's Letheon, recalled Wells initial demonstration in less than complementary terms, calling it an experiment in "tooth-pulling."[221] Reports of this nitrous oxide demonstration often categorized it in terms of tooth-pulling and dentistry rather than recognizing Wells' desire to demonstrate a general principle which could be used in any surgical

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[218] Gardner Quincy Colton, *A True History of the Discovery of Anaesthesia : A Reply to Elizabeth Whitman Morton* (New York: A.G. Sherwood, 1896), 5.

[219] James McManus, *Notes on the History of Anaesthesia : The Wells Memorial Celebration at Hartford, 1894: Early Record of Dentists in Connecticut* (Hartford: Clark & Smith, 1896), 9.

[220] Horace Wells, "Original Discoverer of the Application of Etherization to Surgery," *Lancet* 49, no. 1235 (1847): 471.

[221] Henry Jacob Bigelow, "Nitrous Oxide Gas for Surgical Purposes in 1848.," *Boston Medical & Surgical Journal* 72 (1868): 142.

procedure. Whereas Wells claimed that he was attempting to demonstrate the general principle of painless surgery, Richard Dana in his report limited the utility of Wells' demonstration to dental practice, a definite step down in prestige from the surgical community at Massachusetts General Hospital. Dana additionally recalled the general reaction in the Boston medical community to Wells' demonstration:

> This experiment was made before a large company, Dr. Morton being present; and as the experiment was an entire failure, it subjected Dr. Wells to a good deal of ridicule, as well as Dr. Morton, who, being then a student at the Medical College, had introduced Wells to several members. This experiment and its object were not only known to Dr. Warren and the medical class, but, then or soon after, to Dr. C. T. Jackson, and to Dr. Hayward, and other physicians; and, in fact, it was a matter of considerable notoriety.[222]

This account shows that Wells' experiment was not only well known by medical practitioners in Boston, but it was known as an abysmal failure. The news soon traveled throughout the medical community, and Wells' failure became a paradigm case of charlatanism during the middle of the 1840s. Morton, in one of his many memoirs, mentions an episode between himself and Charles Jackson. They were joking among themselves, talking about playing tricks on patients. Morton, who had come to Jackson to get a silk gas-bag, remarked that he might try to administer air and tell his patient that there was gas in it, just to see how the patient might react. They both laughed at the prospect. Then Morton remembers that Jackson,

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[222] Richard H. Dana, "A History of the Ether Discovery. Report of the Massachusetts General Hospital," *Littell's Living Age*, no. 201 (1848): 530.

> ... added, in a graver manner, that I had better not attempt such an experiment, lest I should be set down as a greater humbug than Wells with his nitrous oxide gas.[223]

Wells had the misfortune of placing himself smack in the middle of a social context which did nothing but undermine his authority. First, he was removed from the operating dome, a location of serious professional medical procedure and the place where students are initiated into the professional realm of surgery. Whereas assisting a famous surgeon in a difficult operation would have elevated Wells in the eyes of his observers, performing a tooth extraction was understood by the medical students as a low-level skill, not even a professional or medical one. Even Warren's lecture room would have been a better location then the anonymous room that Wells later occupied. Finally, the students were already in a frame of mind to inhale nitrous oxide recreationally. They understood that the substance was a stimulant, and they knew that its unusual effects were part of the fun. After being dismissed by Warren's sardonic remarks in front of the class, Wells was in no position to command the respect of a group of students that had gathered together for the purpose of engaging in intoxication and buffoonery. Wells' demonstration was doomed, and his public humiliation prevented the sensitive dentist from trying to convince others of the efficacy of nitrous oxide.

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[223] William Morton quoted in Richard H. Dana, "A History of the Ether Discovery. Report of the Massachusetts General Hospital," *Littell's Living Age*, no. 201 (1848): 568.

Figure 11. Portrait of William Morton. Trials of a Public Benefactor. (New York: Pudney & Russell, 1858). Frontispiece.

In this section we shall see how the physical location and audiences of these demonstrations that in Wells' case contributed to his failure, served to help Morton's credibility in medical circles. Morton's successful demonstration was actually a series of three experiments at Massachusetts General Hospital in the fall of 1846. While the first two were deemed successful by witnesses at the time they were performed, the third marked a turning point for Morton when he revealed the key ingredient in his anesthetic compound to hospital surgeons.

On 16 October 1846, Morton was scheduled to administer a mysterious vapor compound he called "Letheon" to Gilbert Allen, a twenty-year-old patient who was having a large facial tumor removed by chief of surgery Warren at the Massachusetts General Hospital. The event had been set up with the Hospital by Henry Jacob Bigelow, a young surgeon on staff. Bigelow had been intrigued by Morton's earlier newspaper advertisements claiming pain-free dental extractions, and had gone to see Morton about the greater applicability of his compound. Morton, practicing dentistry and no longer associated with Massachusetts General Hospital in any way, was eager to cultivate their friendship as a way to introduce his compound into wider practice.[224]

At ten o'clock a.m., the scheduled hour of the operation, Allen was sitting upright strapped to the surgical table, a common position for many procedures. The surgical arena was filled with student observers from Harvard, and a bevy of Boston's most respected surgical minds were gathered nearby to observe the procedure.

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[224] For detailed analysis on the relationship between Morton and Bigelow and how it served to aid Morton's experiments, cf. Stephanie Browner, "Ideologies of the Anesthetic: Professionalism, Egalitarianism and the Ether Controversy.," *American Quarterly* 51, no. 1 (1999): 108-143.

However, Morton was nowhere to be found. Washington Ayer, one of the student observers later recalled that after several awkward moments of silence, Warren informed the assembly that they were waiting on an individual who claimed to have a compound that would, by inhalation, render patients insensible during surgery. Ayer remembered that "Those present were incredulous," but Warren insisted that the assembly wait a few more moments for Morton to arrive.[225] Morton ran into the operating arena at 10:25, apologized, and stated that he had needed to make some last minute adjustments to his apparatus.

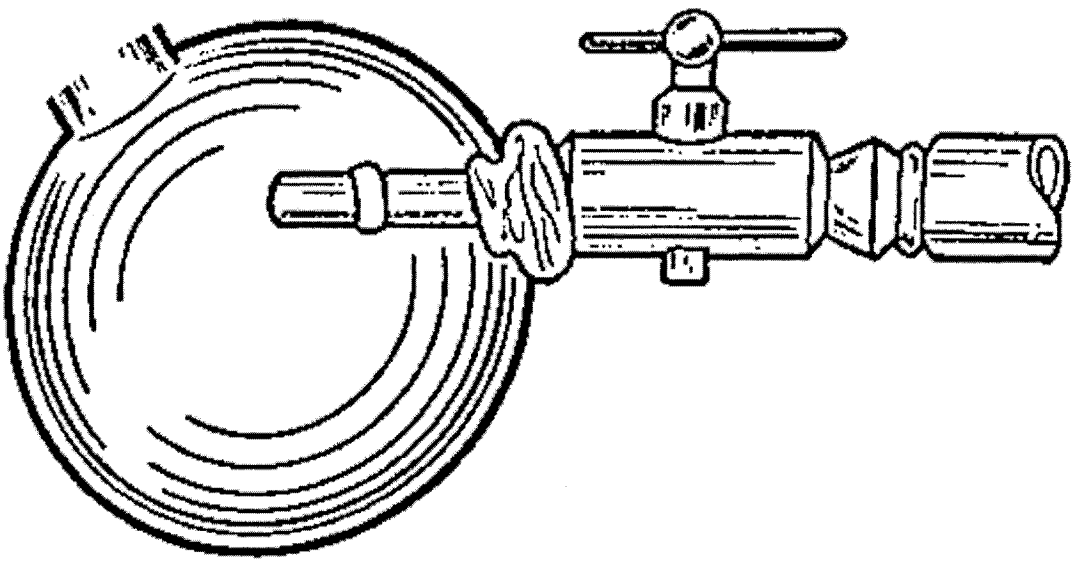

Figure 12. Morton's new Letheon inhaler created and first used 16 October 1846.[226]

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[225] Washington Ayer quoted in Julie M. Fenster, *Ether Day: The Strange Tale of America's Greatest Medical Discovery and the Haunted Men Who Made It*, 1st ed. (New York: HarperCollins, 2001), 19-20.

[226] W. T. G. (William Thomas Green) Morton, *Morton's Letheon Circular*, 5 ed. (Boston: [privately printed], 1847).

The day before the scheduled surgery, Morton had enlisted the services of Joseph Wightman, former assistant to the famous Boston scientific instrument maker Josiah Holbrook. In a near panic for lack of time, Morton convinced Wightman to construct a glass globe with a stem containing a series of valves.[227] Morton had been waiting at Wightman's workshop for the craftsman to put the finishing touches on his new inhaler. When he arrived at the surgical arena, Morton had with him a completely new apparatus, one so new that even he had never tested it.

Warren told Morton to proceed. Morton instructed the patient to inhale from the mouth-piece on the globe. It took some time before the compound took effect; the patient inhaled from Morton's apparatus for about four or five minutes. Once the patient appeared to be insensible, Morton told Warren that the patient was ready for surgery. Warren was pleasantly surprised that for the first minute of the short operation, the patient appeared to be insensible. But as Warren reached the conclusion of the procedure, the patient began to show signs of serious distress.

> Then followed the insulation of the veins, during which he [the patient] began to move his limbs, cry out, and utter extraordinary expressions. These phenomena led to a doubt of the success of the application, and in truth I was not satisfied myself, until I had, soon after the operation, and on various other occasions, asked the question whether he suffered pain. To this he always replied in the negative ; adding, however, that he knew of the operation, and comparing the stroke of the knife to that of a blunt instrument passed roughly across his neck.[228]

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[227] Paul W. Stoddard, "The American Lyceum" (Ph. D., Yale University, 1947), 63-67.

[228] John Collins Warren, *Etherization: With Surgical Remarks* (Boston: William D. Ticknor & Company, 1848), 5-6.

Warren was impressed by Allen's insistence that pain had been mitigated by Morton's procedure, as were the medical student observers. Robert T. Davis, who was a student attending the demonstration, recalled that the skeptical observers unanimously considered Morton's administration to be a legitimate success.

> The exhibition of the anaesthetic was admitted by those present to be a complete success. The operating surgeon expressed his satisfaction in these emphatic words : "Gentlemen, this is no humbug."[229]

The fact that Warren emphasized that Morton's Letheon is "no humbug" to his audience of medical students and surgeons testifies to the notoriety of Wells' failure nearly two years prior. In early 1840s America, "humbug" was a commonly known derogatory term referring to any morally reprehensible economic, social or political deception.[230] Wells had been ridiculed as a humbug, and as we saw in the last section, a notorious one. Warren's public pronouncement at the conclusion of the surgery that Morton was "no humbug" functioned as one step towards legitimating Morton and his Letheon in the Boston medical community.

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[229] Robert T. Davis, "Reminiscences of 1846," in *The Semi-Centennial of Anaesthesia* (Boston: Massachusetts General Hospital, 1897), 20.

[230] James W. Cook, *The Arts of Deception: Playing with Fraud in the Age of Barnum.* (Cambridge, MA: Harvard University Press, 2001), 23. Some examples on contemporary texts that address "humbugs" include: Antiquack, "Surgical Humbug," *Lancet* 9 (1826): 646-647, Thomas J. Lees, *The Age of Humbugs, the Grand Tour and Other Original Poems* (Wheeling, WV: Times Press, 1837), David Meredith Reese, *Humbugs of New-York: Being a Remonstrance against Popular Delusion; Whether in Science, Philosophy, or Religion* (Boston: Weeks, Jordan & Co., 1838), Yankee, *Humbug, or, an Exposé of the Operation of "a Faculty Hitherto Unknown," by Which "the Mysterious Lady" Is Enabled to Perform Apparent Impossibilities* (Boston: Russell, Odiorne, & Metcalf, 1834).

In addition, the behavior of Morton's patient under the influence of his compound sounds very much like the behavior of Wells' patient: both claimed after regaining their senses that the inhalation made them insensitive to pain, but nonetheless both cried out during the procedure. In the case of this first operation in which Morton applied the Letheon, the testimony of the patient after the operation was that he had felt pain, but assumed that it had been mitigated by Morton's compound.

> During the operation the patient muttered, as in a semi-conscious state, and afterwards stated that the pain was considerable, although mitigated; in his own words, as though the skin had been scratched with a hoe.[231]

In Wells case, an outcry was evidence of a failure, while the testimony of the patient was disregarded. For Morton's demonstration, the outcry of the patient was less important than the testimony that his pain had been mitigated.

By the time the second demonstration of Letheon was scheduled for the following day, 17 October 1846, news had spread throughout the medical school that there was a new surgical breakthrough.[232] The surgical arena was standing room only, with prestigious Dr. George Hayward, who would soon take over from Warren as the head of surgery at Massachusetts General Hospital, removing a tumor from the arm of a female patient. The operation was longer

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[231] Henry Jacob Bigelow, "Insensibility During Surgical Operations Produced by Inhalation," *Boston Medical & Surgical Journal* 35 (1846): 310.

[232] For information about the medical students anticipation of the second Letheon demonstration see Julie M. Fenster, *Ether Day: The Strange Tale of America's Greatest Medical Discovery and the Haunted Men Who Made It*, 1st ed. (New York: HarperCollins, 2001), 106-116.

than the first, approximately seven minutes, and Morton periodically made the patient inhale from his glass globe at various intervals to assure that she remained insensible.

> On the following day, an operation for the extirpation of a tumor from the arm was performed by Dr. Hayward, during which the patient exhibited no sign of physical or intellectual suffering.[233]

At this point, the surgeons had already begun to redefine suffering. This female patient did cry out and thrash about during the procedure. She explained her behavior after regaining her senses as the reaction to a disturbing dream she was having about a child that she had left alone at her home.

> The operation lasted four or five minutes, during which the patient betrayed occasional marks of uneasiness; but upon subsequently regaining her consciousness, professed not only to have felt no pain, but to have been insensible to surrounding objects, to have known nothing of the operation, being only uneasy about a child left at home.[234]

For Warren, Bigelow and the witnesses, the patient's behavior was not categorized in any way as indicating suffering, and the rest of the professional staff on hand for the procedure agreed with this summation. Thus the patient could be relied upon to corroborate the professional attending surgeon's conclusion, but evidence contrary to the conclusion that no pain was experienced during the operation was dismissed by the medical professionals.

After two successful demonstrations of Letheon, Morton decided that it would be in his best interests to patent Letheon. On 27 October 1846, Morton and Jackson, the apothecary and

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[233] John Collins Warren, *Etherization: With Surgical Remarks* (Boston: William D. Ticknor & Company, 1848), 6.

[234] Henry Jacob Bigelow, "Insensibility During Surgical Operations Produced by Inhalation," *Boston Medical & Surgical Journal* 35 (1846): 310.

chemist who had suggested that Morton use ether to quell surgical pain, signed a partnership contract and submitted papers for a patent on "Letheon."[235] They applied for a patent this same day, the papers having been drawn up by Boston patent lawyer R. H. Eddy, Esq.[236] Morton immediately set out specific prices for the use of Letheon.

> The scale of prices being, for cities of over one hundred and fifty thousand inhabitants, *two hundred* dollars : fifty thousand and under, *one hundred and fifty* dollars : cities under five thousand, *thirty-seven* dollars, for a term of seven years.[237]

He was able to quickly sell the rights to some practitioners, based on his success in Boston.[238]

But not to Massachusetts General Hospital.

Morton had been evasive when questioned by the medical professionals as to what was the key ingredient in the mysterious compound that he was administering. The surgeons on hand suspected that the substance he used was suphuric ether, well known to both the medical and lay community for its intoxicating effects. They recognized its characteristic sickly-sweet odor. For the operations in the surgical dome, Morton attempted to camouflage the odor by using "aromic essences," trying to keep the identity of his compound hidden from his medical audience. Morton's reluctance to freely share his discovery without compensation deeply

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[235] Gardner Quincy Colton, *A True History of the Discovery of Anaesthesia : A Reply to Elizabeth Whitman Morton* (New York: A.G. Sherwood, 1896), 5.

[236] Truman Smith and P. W. Ellsworth, *An Inquiry into the Origin of Modern Anaesthesia* (Hartford, CT: Brown and Gross, 1867), 20-21.

[237] James McManus, *Notes on the History of Anaesthesia : The Wells Memorial Celebration at Hartford, 1894: Early Record of Dentists in Connecticut* (Hartford: Clark & Smith, 1896), 14.

[238] Gardner Quincy Colton, *A True History of the Discovery of Anaesthesia : A Reply to Elizabeth Whitman Morton* (New York: A.G. Sherwood, 1896), 10.

disturbed the surgeons. Having tasted success, they desired to apply the compound liberally in their surgeries, and were angered that Morton was unwilling to give them permission to do so. They most certainly were not going to pay for the right to use sulphuric ether. Warren as head of surgery made a decision: no more applications of ether until it was free of pecuniary entanglements.

> At this period, however, I was checked by the information, that an exclusive patent had been taken out, and that no application could be made without the permission of the proprietor. The knowledge of this patent decided me not to use, nor to encourage the use of the inhalation, until a more liberal arrangement could be made.[239]

Still Morton would neither reveal the ingredients in Letheon nor give permission for the hospital to use it freely. He refused to tell what Letheon was made of, and Warren refused to allow him access to the surgical patients at Massachusetts General until he was willing to admit that he was merely using suphuric ether, and allow the hospital to use his compound without paying for any "rights." By patenting ether as Letheon, Morton had not only constructed a situation which would allow him to make considerable amounts of money off of a common substance, but he also had eliminated the potential bias of witnesses who might have held beliefs about ether related to its more frivolous applications. In patenting the compound, he had hoped to both conceal Letheon's identity and secure the sole rights to its production and sale.

> When Dr. Morton brought out his anaesthetic, he called it "Lethean" [sic.] in order to deceive the public, so he could sell "rights."[240]

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[239] John Collins Warren, *Etherization: With Surgical Remarks* (Boston: William D. Ticknor & Company, 1848), 6-7.

[240] Gardner Quincy Colton, *A True History of the Discovery of Anaesthesia : A Reply to Elizabeth Whitman Morton* (New York: A.G. Sherwood, 1896), 10.

Still, he was not selling the rights with the speed that he might have liked. Morton went back to Massachusetts General at the beginning of November and approached Dr. Hayward, who had taken over from Warren as the head of surgery. Morton's patent lawyer had suggested that he needed to demonstrate Letheon during a much more serious procedure in order to further prove its efficacy. So far the surgeries had not been complicated or life-threatening. Morton needed to show that Letheon could save lives by applying it in a surgery where the patient's life was at stake. Hayward was not receptive to letting Morton keep using the prestige of the Hospital for his demonstrations while simultaneously denying their surgeons free and unlimited use of the compound.

> I did not intend to allow the surgical patients to inhale this preparation of Dr. Morton during my period of service, unless all the surgeons of the Hospital were told what it was.[241]

Morton conceded. He wrote a letter to Hayward dated and delivered 6 November 1846, admitting that the key ingredient of Letheon was sulphuric ether. He additionally asked to apply it during the amputation of a leg that was scheduled for the following day.[242]

On 7 November 1846, Morton waited near the surgical dome to hear if he would be allowed to administer ether for the operation. At eleven o'clock, the scheduled time of the operation, the surgeons were gathered around the patient in the surgical dome, discussing

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[241] George Hayward, "Some Account of the First Use of Sulphuric Ether by Inhalation in Surgical Practice," *Boston Medical & Surgical Journal* 36 (1846): 231.

[242] Morton was in constant contact with Bigelow, who apprised him of events at the hospital and served as his intermediary with the surgeons. It was Bigelow who convinced Morton to comply with the wished of the surgeons and ask to assist on the 7 November amputation.

whether or not they should allow Morton in. When they came to their decision and agreed to let Morton etherize their patient, Bigelow ran from the room to find Morton and tell him the news. He was allowed to administer the compound again, with the agreement that Massachusetts General would have free and unlimited use. Morton administered his ether compound to Alice Mohan prior to her having a leg amputated by Dr. Hayward.[243]

> Being made to inhale the preparation, after protesting her inability to do so from the pungency of the vapor, she became insensible in about five minutes. The last circumstance she was able to recall was the adjustment of the mouth piece of the apparatus, after which she was unconscious until she heard some remark at the time of securing the vessels--one of the last steps of the operation. Of the incision she knew nothing, and was unable to say, upon my asking her, whether or not the limb had been removed. She refused to answer several questions during the operation, and was evidently completely insensible to pain or other external influences.[244]

This third demonstration served to finalize the adoption of ether in surgical procedures in New England. Even after the medical faculty in Boston become aware that Letheon was simply ether with some added perfumes, they continued to use the substance as an anaesthetic, having experienced several stunning surgical successes.

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[243] Daniel Denison Slade, "The First Capital Operation under the Influence of Ether," *Scribner's Magazine* (1892): 521-522.

[244] Henry Jacob Bigelow, "Insensibility During Surgical Operations Produced by Inhalation," *Boston Medical & Surgical Journal* 35 (1846): 15.

Ether became the surgical anaesthetic of choice for physicians for the following 15 years.[245] Morton received and attempted to enforce his patent, but found it was impossible to make physicians pay for the right to use ether in their practices.

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[245] Cf. "Anaesthetic Agents," *Transactions of the American Medical Assoc* 1 (1848), P. W. Allen, "On the Advantages of Anaesthesia and the Relative Value of Its Different Agents.," *Eclectic Medical Journal* 2 (1850), Henry J. Bigelow, "Anaesthetic Agents, Their Mode of Exhibition and Physiological Effects," *Transactions of the American Medical Assoc* 1 (1848), Henry J. Bigelow, *Ether and Chloroform, Their Discovery and Physiological Effect* (Boston: 1848), Thomas E. Bond, "Insensibility Produced by Ethereal Inhalation," *Boston Medical & Surgical Journal* 35 (1846): 445-448, Henry Bryant, "Inhalation of Ether in Paris," *Boston Medical & Surgical Journal* 36 (1847): 389, Walter Channing, *A Treatise on Etherization in Childbirth* (Boston: W. D. Ticknor and Co., 1848), J. Clark, "Inhalation Ether in Labor," *Boston Medical & Surgical Journal* 37 (1847): 214-216, George Edwards, "Case of Amputation of the Thigh under the Influence of Aether," *Provincial Medical and Surgical Journal* (1847): n.p, F. Willis Fisher, "The Ether Inhalation in Paris," *Boston Medical & Surgical Journal* 36 (1847): 109-113, Josiah Foster B. Flagg, *Ether and Chloroform: Their Employment in Surgery, Dentistry, Midwifery, Therapeutics, Etc.* (Philadelphia: Lindsay & Blakiston, 1851), Josiah Foster B. Flagg, "The Inhalation of Ethereal Vapor to Prevent Sensibility to Pain During Surgical Operations. Letter to the Editor," *Boston Medical & Surgical Journal* 35, no. 8 (1846): 357, Josiah Foster B. Flagg, "Inhalation of Suphuric Ether," *Boston Medical & Surgical Journal* 36 (1846), George Hayward, *Remarks on the Comparative Value of the Different Anaesthetic Agents.* (Boston: David Clapp, 1850), George Hayward, "Some Account of the First Use of Sulphuric Ether by Inhalation in Surgical Practice," *Boston Medical & Surgical Journal* 36 (1846): 231, N. C. Keep, "Letter to the Editor (Obstetric Use of Ether)," *Boston Medical & Surgical Journal* 36 (1847): 226, J. D. Mansfield, "The Inhalation of Ethereal Vapor, Etc.," *Boston Medical & Surgical Journal* 35 (1846): 424-425, E. E. Marcy, "Inhalation of Ether to Prevent Pain," *Boston Medical & Surgical Journal* 36 (1847): 4995-497, E. R. Smilie, *An Address Delivered before the Class of the Castleton Medical College on the Original Application of Anaesthetic Agents* (Boston: Jewett & Co., 1848), W. Clay Wallace, "Remarks on the Inhalation of Ether Previous to Surgical Operations," *Boston Medical & Surgical Journal* 35 (1846), John Collins Warren, *Etherization: With Surgical Remarks*

Nitrous oxide, in contrast, was ignored by medical men. Wells' notorious failure served as a warning to researchers who might have expressed interest in the gas for surgical purposes. With this complete and utter failure attached to the reputation of the gas, it would be nearly twenty years before serious inquiry into its anesthetic properties was once again acceptable. In chapter 5, we shall see how nitrous oxide was reintroduced into medical practice, due primarily to the near evangelical efforts of entertainer Gardner Quincy Colton.

(Boston: William D. Ticknor & Company, 1848), John Collins Warren, "Inhalation of Ethereal Vapor for the Prevention of Pain in Surgical Operations," *Boston Medical & Surgical Journal* 35 (1846).

Chapter 5. The nitrous oxide revival

Morton's Massachusetts General Hospital experiments acted as a catalyst for ether use and adoption into surgical practice. Ether was suddenly in vogue after the 1846 experiments as a viable alternative to the wretched pain of surgery. But what happened to nitrous oxide? This chapter addresses the complex interactions between entertainment and medical innovation by examining how nitrous oxide was re-introduced as an anesthetic in the 1860s. The introduction of nitrous oxide into dental practice was due almost entirely to the continued work of Gardner Quincy Colton, the man who showed Horace Wells the effects of nitrous oxide in 1844. By surveying over one thousand articles about and advertisements for the gas placed by Colton in the *New York Times* during the late Nineteenth-Century, we get the impression of Colton as a liminal figure who understood the advantages of both science and amusement. After 1860, Colton used nitrous oxide in at least two different contexts. One, he continued to give large public lectures on the gas, similar to the kinds of public entertainments we examined in Chapter 3. Two, he administered nitrous oxide to patients at the Colton Dental Association, the first dental clinic dedicated to tooth extractions exclusively using nitrous oxide to suppress pain. Colton's continued use of the gas assured that it would be adopted by dentists during the 1860s. Additionally, Colton spent much of the late 1860s in Europe, demonstrating the efficacy of nitrous oxide as an anesthetic. By the early 1870s, nitrous oxide was a common anesthetic, used in both dental and surgical operations throughout the western world. Yet Colton continued to

present his laughing gas exhibitions, public events which had played such a key role in the construction and stabilization of the American middle class.

Colton and nitrous oxide

Colton spent the majority of his adult life lecturing on nitrous oxide. In his youth Colton aspired to a life of medicine. However in 1844, Colton was forced to drop out of the College of Physicians and Surgeons in New York, having run out of tuition money. Recalling his experiences in the classroom with the gas, and at the at the suggestion of his friend P. T. Barnum, Colton took up lecturing on nitrous oxide as a vocation. He maintained a brutal schedule of itinerant lecturing and exhibiting of the gas. Besides all of New England, Colton also visited Pittsburgh, Cincinnati, Louisville, New Orleans, and Mobile during the 1840s.[246] Exhausted, Colton followed his brother Walter to California in 1849, hoping to cash in during the great gold rush.[247] Colton returned to New York in 1861, destitute, and rekindled his

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[246] A. J. Wright, "G.Q. Colton's 1848 Visit to Mobile, Alabama," *Anesthesiology* 91, no. 3A (1999): n.p. As a Nineteenth-Century entrepreneur, Colton also devised an electric motor, and first exhibited it alongside nitrous oxide during his lectures in Pittsburgh in 1847. The machine was made from his plans by a mathematical-instrument-maker named Lilly, and is believed to be the first electric locomotive operated in this country. His only reprise from nitrous oxide lecturing was during the 1850s.

[247] In 1849 Colton went to California, and for several months worked in the newly discovered gold mines. He relied upon his early medical training and his business sense when he began practicing medicine in a frontier with few physicians. Heading to San Francisco near the end of 1849, he was appointed Justice of the Peace by Governor Riley, the first such appointment in California. Colton returned to the east in the early 1860s. He promptly lost all that he had acquired during the California gold rush by investing in a failing Syracuse salt-works. In 1861, he dabbled in publishing, but remained restless and unsatisfied with his returns. He returned to lecturing on nitrous oxide in 1862. Cf. Gardner Quincy Colton, *Boyhood*

acquaintance with Barnum. On 8 January 1862, Colton produced his first laughing gas exhibition in over ten years at the Brooklyn Athenaeum. This was followed by a successful exhibition at the Cooper Institute in New York.

After his exhausting experiences in the 1840s, Colton decided to limit his exhibition tours to New England. He also determined to lecture only part of the year, taking the summer seasons off. This schedule was advantageous in that it allowed Colton free time to pursue other interests during the off-season, spending time with family and friends.[248]

> About six months in the fall, winter, and spring of each year were thus occupied, and at least two exhibitions were given every week, sometimes three or four, and the gas was usually administered to twelve or fifteen persons on each occasion.[249]

Over the course of time thousands attended his frequent lectures. Colton was one of the most famous and well respected scientific entertainers of the 1860s. He was even the subject of parody,

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and Manhood Recollections: The Story of a Busy Life (New York: A. G. Sherwood, 1897), Gardner Quincy Colton, *Musings on Cheerfulness and Health : How to Reach 80 Years of Age : By One of Them* (New York: s.n., 1894), Laird W Nevius, *The Discovery of Modern Anaesthesia: By Whom Was It Made? A Brief Statement of Facts* (New York City: George W. Nevius, Cooper Institute, 1894), 93-94. For his publishing of maps, Cf. Charles T. Jackson, *Manual of Etherization* (Boston: Mansfield, 1861).

[248] Colton was very interested in religion, writing several books and pamphlets on the subject later in life. Cf. Gardner Quincy Colton, *Shakespeare and the Bible: Parallel Passages and Passages Suggested by the Bible with the Religious Sentiments of Shakespeare* (New York: Thomas R. Knox & Co., 1888), Gardner Quincy Colton, *We See through a Glass Darkly.* (New York: E. M. Day, 1891).

[249] Truman Smith and P. W. Ellsworth, *An Inquiry into the Origin of Modern Anaesthesia* (Hartford, CT: Brown and Gross, 1867), 130.

when in September 1863 a Brooklyn theatrical troupe in New York performed a satire of Colton's nitrous oxide exhibitions called "Dr. Gas 'em's Laughing Gas."[250]

Despite being renown as an entertainer, Colton emphasized the potential medical utility of nitrous oxide in his shows. In his new series of nitrous oxide exhibitions, Colton added to his lecture narrative the story of how Wells' had gleaned the idea of using nitrous oxide for tooth extractions in 1844. In doing so, Colton was able to expose an entirely new audience to the idea that nitrous oxide could be used to quell pain. Since he aimed his advertisements towards the upper and middle classes, his audiences often included dental and medical professionals. Some of these individuals were impressed by Colton's narrative on Wells' initial successes with the gas. Colton happily complied with personal requests from dentists, showing them exactly how to make and use the gas in their own practices. He first was asked to bring the gas into a dental practice in New Britain, Connecticut.

> On one occasion, at New Britain, Conn., during the summer of 1862, after stating the above facts respecting Wells, a lady asked me if I would administer to her the gas, and have a dentist--whose office was in the building--extract some teeth. I consented and the dentist, whose name escapes me at this moment [Dr. R. C. Dunham], extracted teeth not only for this lady, but for two others. The dentist was so delighted with the operation. That he insisted upon my instructing him on how to make the gas.[251]

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[250] "Amusements," *Brooklyn Daily Eagle* September 21, 1863, 3, "Classified Advertisement," *Brooklyn Daily Eagle* September 26, 1863, 1.

[251] Gardner Quincy Colton, "Nitrous Oxide," *Monthly review of dental surgery* 2 (1873-74): 29. The identity of this dentist can be found in Barbara M. Duncum, *The Development of Inhalation Anaesthesia; with Special Reference to the Years 1846-1900* (London: Oxford University Press, 1947), 273.

New Britain dentist R. C. Dunham asked Colton to administer nitrous oxide to a few of his patients. Colton complied with Dunham's request and as a consequence of their collaboration, the Dunham began using nitrous oxide regularly in his practice for tooth extractions. Colton met with a similar situation in Hartford, Connecticut, instructing yet another dentist in the use of nitrous oxide.

Having already instructed several dentists in the use of the gas, Colton set up a small gathering in New Haven in June of 1863 to demonstrate the efficacy of nitrous oxide in dental procedures.[252] Dr. Joseph H. Smith was present at this New Haven entertainment, and requested from Colton details about the gas. Smith offered to try nitrous oxide out in his dental practice if Colton would be willing to administer it to his patients. Colton agreed.

> At a private entertainment given in New Haven, I told of Dr. Wells and his experience and remarked that I could never get a dentist to try it. Dr. J. H. Smith, a dentist in New Haven was present and said "I will try it if you will give the gas."[253]

Colton was exaggerating about "never" being able to get a dentist to try the gas; he had instructed at least two dentists in its applications by the end of 1862. However in Smith, Colton found an enthusiastic ally, one who was willing to use the gas extensively after the initial success with an older female patient.

> Their first patient was an old lady, for whom they extracted seven teeth ; after recovering from the effects of the gas, she was so

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[252] James McManus, *Notes on the History of Anaesthesia : The Wells Memorial Celebration at Hartford, 1894: Early Record of Dentists in Connecticut* (Hartford: Clark & Smith, 1896), 18.

[253] Gardner Quincy Colton, "Wells Memorial Celebration: Prof. Gardner Q. Colton, of New York," in *Notes on the History of Anesthesia, the Wells Memorial Celebration Early Record of Dentists in Connecticut*, ed. James McManus (Hartford, CT: Clark & Smith, 1896), 38.

> pleased with the result that she allowed Professor Colton to announce to his next audience her name and that she had seven teeth extracted without pain, and without ill or unpleasant effects from the gas. In three weeks and two days from that time Drs. Smith and Colton extracted over three thousand teeth.[254]

With this woman's endorsement of the gas, Colton had another thread to weave into his nitrous oxide narrative. The additional successful extraction of over 3000 teeth in such a short period of time was an encouraging turn of events. Colton and Smith agreed to a longer trial of the gas in dental practice.[255] After three weeks of success, Colton gleaned the idea that he might like a change of career. He decided to try and focus less on the lecture entertainment aspect of nitrous oxide, and more on the pragmatic dental uses.

No. 22 Bond Street in New York City

In the summer of 1863, Colton set up a permanent location in New York City at which he would administer nitrous oxide for tooth extractions. He contracted a partnership with Drs. W.B. Hurd, J.H. Smith and John Allen. On 13 July 1863 the Colton Dental Association offices at 22 Bond Street opened its doors to customers [figure 14].

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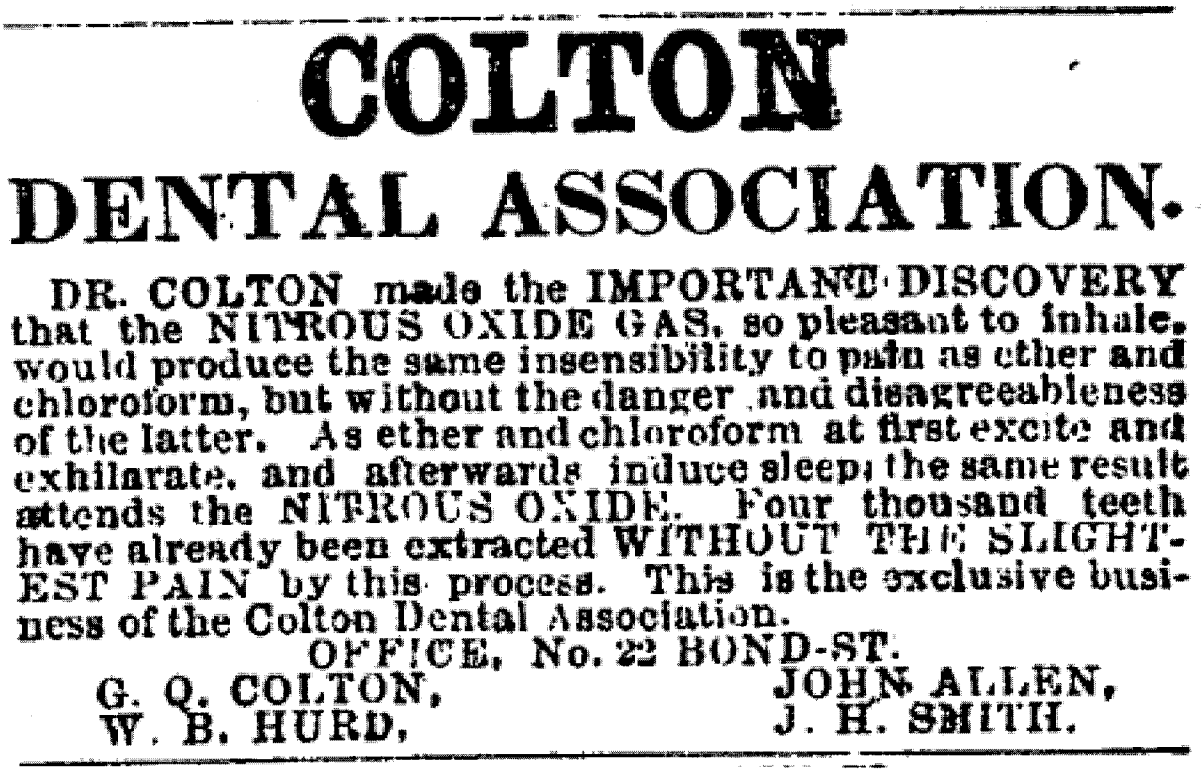
[254] James McManus, *Notes on the History of Anaesthesia : The Wells Memorial Celebration at Hartford, 1894: Early Record of Dentists in Connecticut* (Hartford: Clark & Smith, 1896), 18.

[255] Gardner Quincy Colton, "Wells Memorial Celebration: Prof. Gardner Q. Colton, of New York," in *Notes on the History of Anesthesia, the Wells Memorial Celebration Early Record of Dentists in Connecticut*, ed. James McManus (Hartford, CT: Clark & Smith, 1896), 39.



COLTON

DENTAL ASSOCIATION.

DR. COLTON made the IMPORTANT DISCOVERY that the NITROUS OXIDE GAS, so pleasant to inhale, would produce the same insensibility to pain as ether and chloroform, but without the danger and disagreeableness of the latter. As ether and chloroform at first excite and exhilarate, and afterwards induce sleep; the same result attends the NITROUS OXIDE. Four thousand teeth have already been extracted WITHOUT THE SLIGHTEST PAIN by this process. This is the exclusive business of the Colton Dental Association.

OFFICE, No. 22 BOND-ST.

G. Q. COLTON, JOHN ALLEN,
W. B. HURD, J. H. SMITH.

Figure 13. Early advertisement dedicated to the Colton Dental Association. *New York Times* 9 August 1863 p. 5.

Colton was optimistic that this business would be preferable to his itinerant lecturing and exhibiting work. In retrospect, Colton gives the impression that he got out of the nitrous oxide lecture business altogether when he decided to open his dental clinics.

> Well, thinks I, this is better business than lecturing, and I go to New York, and at the suggestion of P. T. Barnum, I established an institution and called it the Colton Dental Association, because my name had been so long identified with the gas.[256]

[256] Gardner Quincy Colton, "Wells Memorial Celebration: Prof. Gardner Q. Colton, of New York," in *Notes on the History of Anesthesia, the Wells Memorial Celebration Early Record of Dentists in Connecticut*, ed. James McManus (Hartford, CT: Clark & Smith, 1896), 39.

Although itinerant lecturing had advantages in that it ensured a constant turnover of potential patrons, dentistry was a different business altogether. Itinerant dentistry had a reputation akin to quackery and patent medicine peddling.[257] By the middle of the Nineteenth-Century, the first dentistry college in the United States had been established in Baltimore, and dentists were promoting the image of themselves as medical specialists.[258] In order to collaborate with dentists in their newly emergent culture, Colton had to give up his wandering ways. Dentistry as a specialty had shifted from mere "tooth-pulling" to being considered an important aspect of medical treatment during the last half of the Nineteenth-Century. Professor S. D. Gross of Philadelphia when speaking before the American Medical Association said that, "Dentistry is the most important specialty in medicine : many people come into the world, and go out of it, who never require the services of other specialists ; but no child is born who does not sooner or later require the services of a dentist."[259] Interest in nitrous oxide as an amusement may wax and wane, but people would always need tooth extractions, especially with the added incentive of a pain-free experience.

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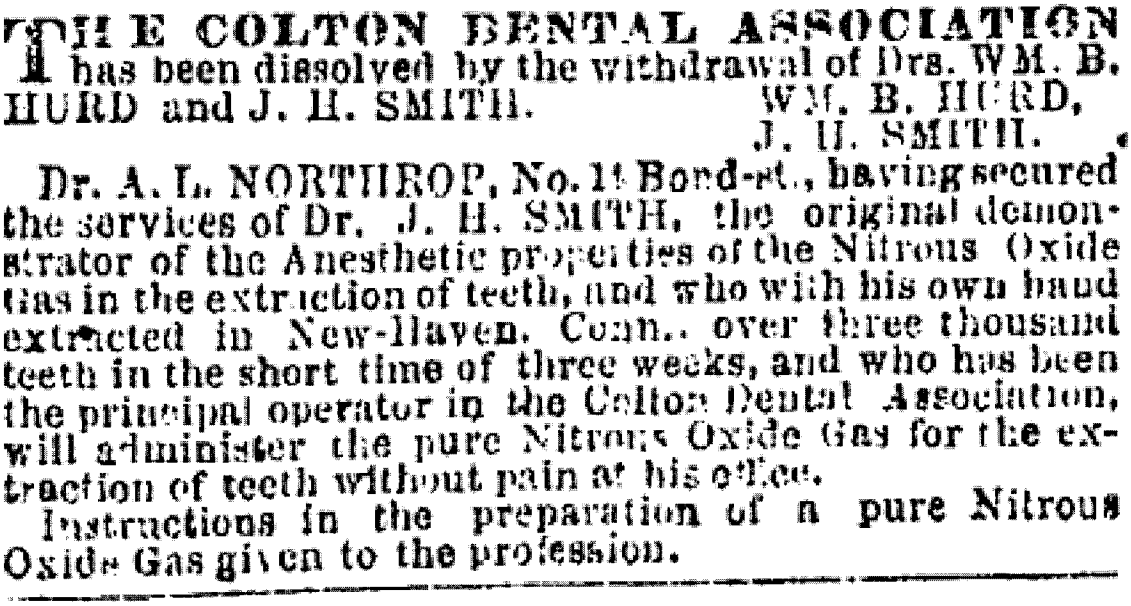
[257] Cf. Roger King, "Curing Toothache on the Stage? The Importance of Reading Pictures in Context.," *History of Science* 33 (1995): 396-416.

[258] For the history of dentistry, cf. Richard A. Glenner, *The American Dentist: A Pictorial History with a Presentation of Early Dental Photography in America* (Missoula, MT: Pictorial Histories Publishing Co., 1990), Sarah Nettleton, *Power, Pain and Dentistry* (Buckingham, UK: Open University Press, 1992), Malvin E. Ring, *Dentistry : An Illustrated History* (New York; St. Louis: Abrams ; C.V. Mosby, 1985), James Wynbrandt, *The Excruciating History of Dentistry Toothsome Tales & Oral Oddities from Babylon to Braces*, 1st ed. (New York: St. Martin's Press, 1998).

[259] Quoted in James McManus, *Notes on the History of Anaesthesia : The Wells Memorial Celebration at Hartford, 1894: Early Record of Dentists in Connecticut* (Hartford: Clark & Smith, 1896), 22-23.

Regardless of Colton's initial optimism, the market for pain-free tooth extractions was not as robust as he had originally anticipated. In September of 1863, after only a few months in business, two of Colton's partners left the Association [figure 15].


THE COLTON DENTAL ASSOCIATION
has been dissolved by the withdrawal of Drs. WM. B. HURD and J. H. SMITH.

WM. B. HURD,
J. H. SMITH.

Dr. A. L. NORTHROP, No. 11 Bond-st., having secured the services of Dr. J. H. SMITH, the original demonstrator of the Anesthetic properties of the Nitrous Oxide Gas in the extraction of teeth, and who with his own hand extracted in New-Haven, Conn., over three thousand teeth in the short time of three weeks, and who has been the principal operator in the Colton Dental Association, will administer the pure Nitrous Oxide Gas for the extraction of teeth without pain at his office.

Instructions in the preparation of a pure Nitrous Oxide Gas given to the profession.

Figure 14. Smith's display advertisement after he left the Colton Dental Association. This ad infuriated Colton because it implied that Smith had discovered that nitrous oxide was an anesthetic. *New York Times* 19 September 1863 p. 8.

With Smith and Hurd gone, Colton and Allen were left to take care of business. But Allen was soon to leave as well. Colton emphasized the ups and downs of his early business, and lamented on the unpredictable returns. He explained how he alone came to be the Colton Dental Association:

> I had three partners, making four of us, equal partners. The agreement was to divide every Saturday night. Well, on the first Saturday night we had nothing to divide. It went on for weeks and months, and took everything to pay expenses. Drs. Hurd and Smith, partners, said we cannot leave a good business to come here. They left. Dr. John Allen, one of the parties in the

> partnership, did not interrupt them. Then Dr. Allen and I were the Colton Dental Association. It went along for some time, sometimes we took in $50 to divide up Saturday night, after paying expenses, and finally Dr. Allen said to me, "here you are, slaving yourself to death for nothing. You take it all." Well, then I was the Colton Dental Association.[260]

Whereas Colton was initially able to persuade three dentists to enter into the partnership, he could not convince any of them to stay. When he and Allen, the last of his four partners, finally parted ways, Colton was left with sole responsibility for the Colton Dental Association.

Colton, however, found that dentists willing to perform tooth extractions were relatively easy to come by. It was the administration of nitrous oxide that was his area of expertise and claim to fame. But Colton wasn't concerned with fame. He was concerned with persuading others to use nitrous oxide as an anesthetic. Colton wrote a circular about the production of nitrous oxide specifically for dentists and offered it free of charge to any dentist who might want to use nitrous oxide in his practice [figure 16].

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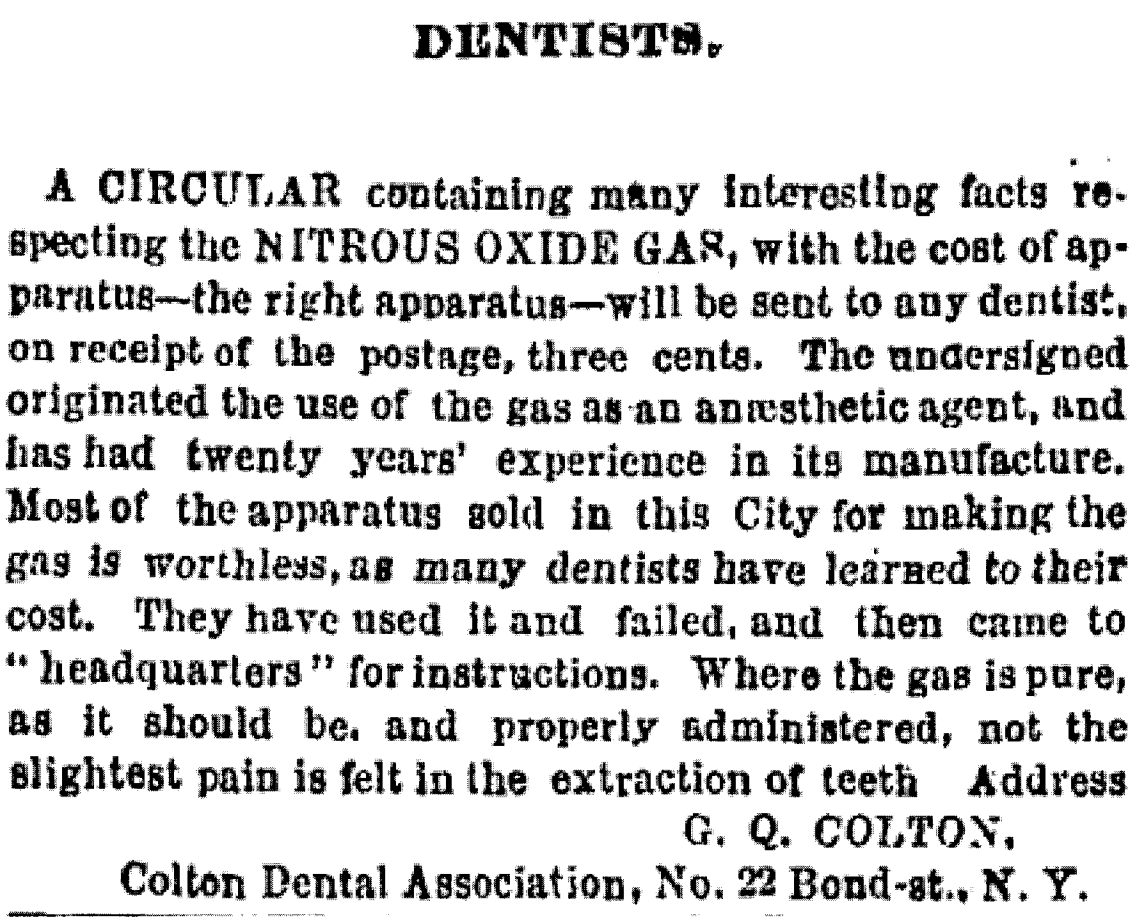
[260] Gardner Quincy Colton, "Wells Memorial Celebration: Prof. Gardner Q. Colton, of New York," in *Notes on the History of Anesthesia, the Wells Memorial Celebration Early Record of Dentists in Connecticut*, ed. James McManus (Hartford, CT: Clark & Smith, 1896), 39.



DENTISTS.

A CIRCULAR containing many interesting facts respecting the NITROUS OXIDE GAS, with the cost of apparatus—the right apparatus—will be sent to any dentist, on receipt of the postage, three cents. The undersigned originated the use of the gas as an anæsthetic agent, and has had twenty years' experience in its manufacture. Most of the apparatus sold in this City for making the gas is worthless, as many dentists have learned to their cost. They have used it and failed, and then came to "headquarters" for instructions. Where the gas is pure, as it should be, and properly administered, not the slightest pain is felt in the extraction of teeth Address

G. Q. COLTON,

Colton Dental Association, No. 22 Bond-st., N. Y.

Figure 15. Colton offered his circular explaining nitrous oxide free of charge to dentists. Display advertisement *New York Times* 10 October 1863 p. 5.

Colton advertised the Colton Dental Association prolifically both in print and at his laughing gas lectures, which he continued to present in New York City. In 1863 and 1864 Colton advertised 26 laughing gas exhibitions, but placed 162 classified advertisements specifically for the Colton Dental Association in the *New York Times*. During these years, Colton also published several

short articles and letters advising the public and medical professionals of his successes with the gas.[261]

His efforts began to make an impression, and dentists and physicians started to take notice of nitrous oxide for surgical anesthesia. Dentist J. S. Latimer wrote a positive account of witnessing Colton administer nitrous oxide prior to the extraction of teeth at the Colton Dental Association. He predicted that many New York dentists, in preparation of fitting false teeth, would send their patients to Colton to avoid painful and unpleasant extractions.[262]

Boston chemist A. W. Sprague wrote in a letter to the editor of *Scientific American*, published in the 5 December 1863 issue, voicing his concern that unqualified individuals attempting to make nitrous oxide from "trashy salts" were endangering those who were demanding the gas as an anesthetic. However, he was pleased to generally advocate the use of nitrous oxide as an anesthetic, if the proper equipment and materials were used.

> With pure nitrate ammonia and a suitable apparatus for decomposing and washing the gas from this, a suitable breathing apparatus, and skill in operating while the patient is insensible, I am confident, from personal experience, that no better agent has yet been discovered for producing anaesthesia.[263]

Sprague sold chemicals and chemical apparatus from his Boston shop, so it is not surprising that he emphasized the need for the proper equipment and pure chemical ingredients. He advertised

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[261] Gardner Quincy Colton, "Letter from New York: The New (or Old) Anaesthetic," *Chicago Medical Examiner* 5, no. 1 (1864): 55, Gardner Quincy Colton, "Nitrous Oxide an Anaesthetic," *Dental Cosmos* 6, no. 1 (1864): 8-10, Gardner Quincy Colton, "Nitrous Oxide as an Anaesthetic," *Scientific American* 9, no. 21 (1863): 327, Gardner Quincy Colton, "Nitrous Oxide Gas an Anaesthetic," *Dental Cosmos* 5, no. 9 (1864): 490-493.

[262] J. S. Latimer, "Nitrous Oxide in Dentistry," *Dental Cosmos* 5, no. 1 (1863): 16-17.

[263] A. W. Sprague, "Abuse of Exhilarating Gas in Surgery," *Scientific American* 9, no. 23 (1863): 358.

that he would gladly send the proper apparatus with detailed instructions on its use for only $16.[264] Sprague's wares were of a high enough quality that by 1867 Colton was exclusively using the apparatus that Sprague had developed for producing and administering nitrous oxide gas.[265]

By 1864 in Chicago, nitrous oxide had become a commonplace anesthetic at dental offices. This popularity, along with the prolific advertisements of "quack dentists," prompted Professor of Surgery at the Chicago Medical College Edmund Andrews to investigate the anesthetic properties of the gas. Andrews' first course of action was to inhale the gas himself, "...in order to judge of the sensations produced by it." He concluded that although nitrous oxide was useful for short dental and surgical procedures, it was of no use as a general anesthetic in major surgical operations.

> Having only 80 or 90 seconds of insensibility in which to operate, the surgeon can seldom use the gas, for if he should continue the inhalation without interruption for many minutes, death would probably ensue from asphyxia.[266]

The length of anesthetic state was not long enough to allow for complicated or protracted surgical operations. Andrews concluded that nitrous oxide would indeed come into permanent use as a dental anesthetic, even if it was not appropriate for long surgeries.

In June of 1864 C. W. Foster published a scathing attack on nitrous oxide and Colton in *Dental Cosmos.* Foster, a dentist, was suspicious of anesthetics in all but the most "grave or

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[264] "Classified Advertisement," *Scientific American* 9, no. 25 (1863): 399.

[265] Gardner Quincy Colton, "Experience in the Use of Nitrous Oxide Gas," *British Journal of Dental Science* 11 (1868): 254.

[266] Edmund Andrews, "Nitrous Oxide, or 'Laughing Gas,' as an Anaesthetic," *Chicago Medical Examiner* 5, no. 2 (1864): 78.

capital surgery," and like Andrews was concerned about asphyxiation. But his specific claim about nitrous oxide was that it was not an anesthetic at all, but a suffocating agent. Any exhilaration felt by the inhaler was due to the effects of carbonic acid gas (carbon dioxide) exhaled and then re-inhaled by the patient as he suffocated.

> Mr. C. has not of course told you that asphyxia (or "death's door," as he poetically terms it) could be more readily and generally produced by nitrous oxide as given, than by chloroform of ether. Of course we may be informed that it will not always do to speak the truth even.[267]

Foster accused Colton of being a liar, endangering patients by suffocating them. Colton responded in the same journal a few months later. He defended nitrous oxide by outlining in detail the proper mode of administration according to his experience. In response to Foster's attack on his character, Colton simply rested on the authority of his experience and successes.

> I claim that after making and administering the gas for the past twenty years, having breathed at least three hundred doses myself within a year and a half past, I ought to know *something* as to its value and safety.[268]

After emphasizing his experience with the gas, Colton again reminded Foster and the readers of *Dental Cosmos* that if administered from a six to eight gallon India rubber bag, nitrous oxide was safe and effective, whereas smaller does sometimes cause symptoms akin to suffocation that so worried Foster.

By the summer of 1864, the news of nitrous oxide use in dentistry had spread throughout the United States. Colton had succeeded in getting dentists to try the gas, and the Colton

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[267] C. W. Foster, "Nitrous Oxide Not an Anaesthetic," *Dental Cosmos* 5, no. 11 (1864): 615.

[268] Gardner Quincy Colton, "Nitrous Oxide an Anaesthetic," *Dental Cosmos* 6, no. 1 (1864): 9. Emphasis in original.

Dental Association was receiving referrals from dentists throughout New York City requesting painless tooth extractions for their patients. But Colton was unsatisfied with the location of the Colton Dental Association. 22 Bond Street was too far off the beaten path to allow for many walk-in customers, and Colton had to advertise prolifically in order to keep business coming in. When he decided to move the Colton Dental Association to a better location, he chose a place that he was familiar with, and one that was famous throughout New York City.

Cooper Institute

Beginning in 1862, Colton gave his laughing gas exhibitions at the Cooper Institute in New York City. The Cooper Institute was a unique educational and charitable institution "...for the advancement of science and art," founded in 1856 by Peter Cooper and chartered in 1859.[269] The facilities included a reading room, a school of art for women, and a lecture hall where political and religious talks were given, the most famous being Abraham Lincoln's address on 21 February 1860 which helped to clinch the presidential election later that year.

The Cooper Institute was an ideal location to give lectures. It was conveniently located at the corner of the Bowery and Seventh Street downtown. The prestige of the Institute was something that Colton was anxious to exploit, and he used it as his exclusive location for presenting his laughing gas entertainments. Starting in February 1862, he tied his name to the charitable reputation of the Cooper Institute by presenting many of his lectures as benefits to

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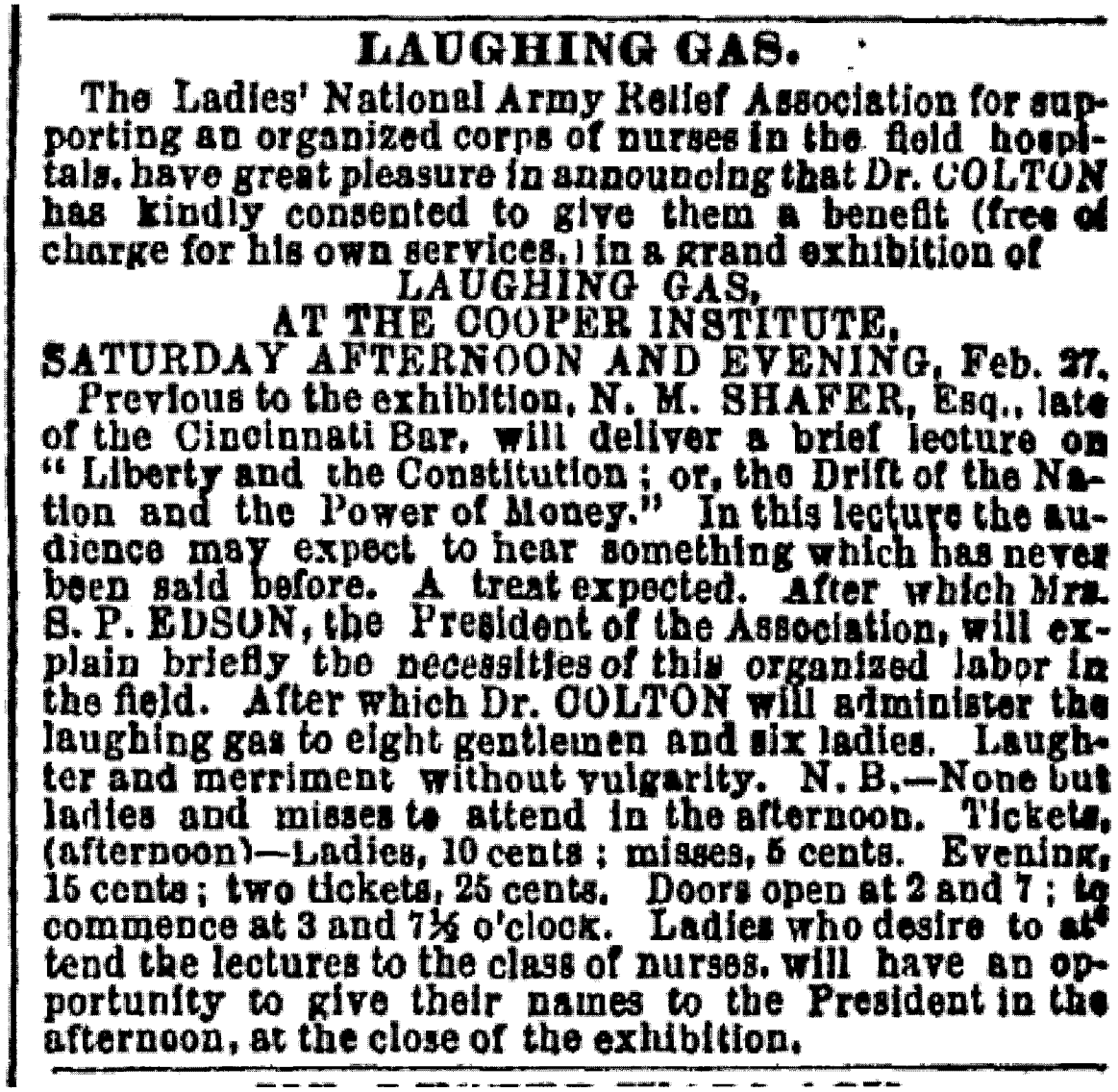
[269] Peter Cooper, "Letter from Peter Cooper to the Trustees of the Cooper Union," (New York: Cooper Union, April 29, 1859), 1.

different charities.[270] At the height of the Civil War in February of 1864, Colton gave a benefit for the Ladies' National Army Relief Association.



LAUGHING GAS.

The Ladies' National Army Relief Association for supporting an organized corps of nurses in the field hospitals, have great pleasure in announcing that Dr. COLTON has kindly consented to give them a benefit (free of charge for his own services,) in a grand exhibition of

LAUGHING GAS,

AT THE COOPER INSTITUTE,

SATURDAY AFTERNOON AND EVENING, Feb. 27.

Previous to the exhibition, N. M. SHAFER, Esq., late of the Cincinnati Bar, will deliver a brief lecture on "Liberty and the Constitution; or, the Drift of the Nation and the Power of Money." In this lecture the audience may expect to hear something which has never been said before. A treat expected. After which Mrs. S. P. EDSON, the President of the Association, will explain briefly the necessities of this organized labor in the field. After which Dr. COLTON will administer the laughing gas to eight gentlemen and six ladies. Laughter and merriment without vulgarity. N. B.—None but ladies and misses to attend in the afternoon. Tickets, (afternoon)—Ladies, 10 cents; misses, 5 cents. Evening, 15 cents; two tickets, 25 cents. Doors open at 2 and 7; to commence at 3 and 7½ o'clock. Ladies who desire to attend the lectures to the class of nurses, will have an opportunity to give their names to the President in the afternoon, at the close of the exhibition.

Figure 16. Colton advertisement for his benefit for the Ladies' Army Relief Association. Classified Advertisement 26 February 1864 *New York Times* p. 7.

[270] Colton's first charitable lecture benefited the Five Points House of Industry in New York in 1862.

The Relief Association had formed in 1861, with one of their purposes being training nurses to assist with the wounded returning from the battle fronts.[271] This benefit, which Colton assured would contain "Laughter and merriment without vulgarity," helped to rally support for a voluntary medical corps consisting of female nurses. Colton continued to present benefit lectures well into the 1870s, including events in support of the New York Infant Asylum and the Independent Order of Good Templars, a popular temperance charity.

With the Cooper Institute being a locus of both moral and educational activity, Colton decided that it would be the best location not just for his lectures, but for the Colton Dental Association as well. However in order to be allowed to rent the coveted rooms at the Cooper Institute, he had to show that the Colton Dental Association was not akin to quackery.

> I then moved to the Cooper Institute, and it was three weeks before I could convince the Trustees of that institution that my business was legitimate. But I finally got the certificate of a physician and they rented me the rooms.[272]

Despite his successes on his own with nitrous oxide, Colton still needed the backing of a physician legitimating his business in order to get the Cooper Institute rooms. Once the subject of his legitimacy was settled at the end of September 1864, Colton moved his Colton Dental

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[271] L. P. Brockett, *Women's Work in the Civil War: A Record of Heroism, Patriotism, and Patience* (Philadelphia: Zeigler & McCurdy, 1867), 527-528.

[272] Gardner Quincy Colton, "Wells Memorial Celebration: Prof. Gardner Q. Colton, of New York," in *Notes on the History of Anesthesia, the Wells Memorial Celebration Early Record of Dentists in Connecticut*, ed. James McManus (Hartford, CT: Clark & Smith, 1896), 39-40.

Association offices to 19 Cooper Institute.[273] This was a far more visible location, on a main thoroughfare, where Colton's ostentatious awnings could attract the attention of passersby [figure 18].

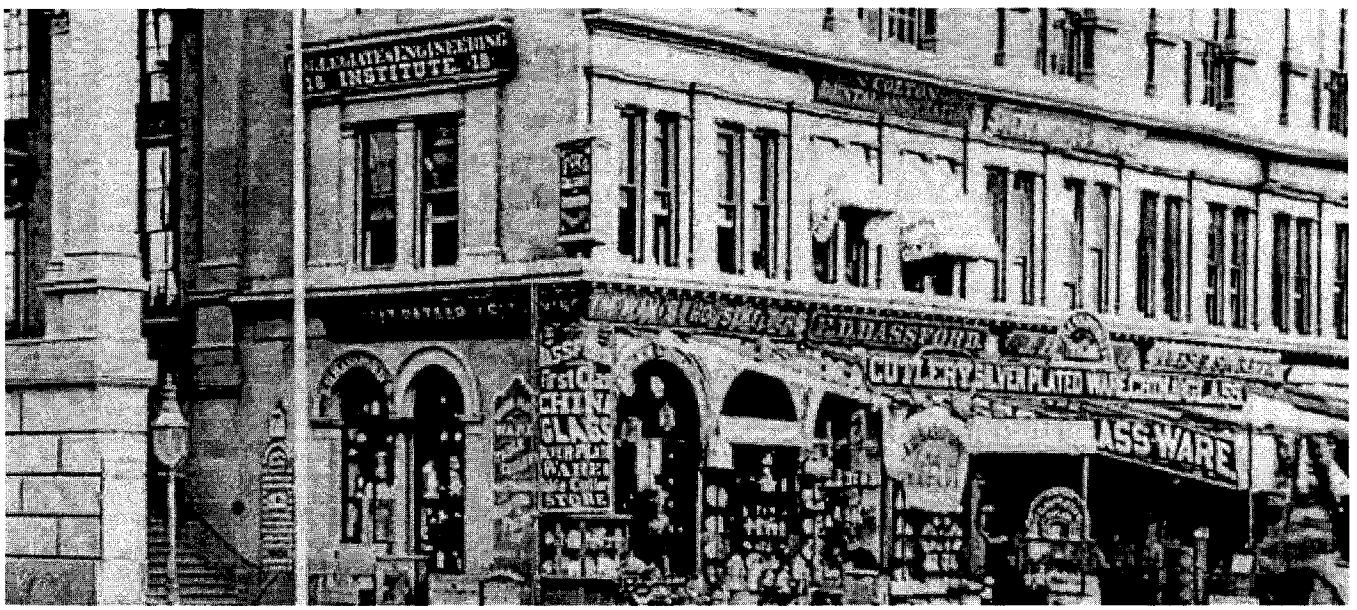

Figure 17. Colton Dental Association at the Cooper Institute circa 1865. Colton's offices are those with awnings. By courtesy of the Cooper Union, New York City.

Colton repeatedly used the term "laughing gas" when he continued to give his entertainments at the Cooper Institute. Laughing gas appears to have been coined by Mr. Henry, a magician who preformed at the Adelphi Theatre in London during the mid-1820s. An 1824 poster of Mr. Henry's first season emphasized laughing gas as the feature of a three part performance. While part one and two were dedicated to illusions and prestidigitation, the last

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[273] "Classified Advertisement," *New York Times* September 26, 1864, 3, Truman Smith and P. W. Ellsworth, *An Inquiry into the Origin of Modern Anaesthesia* (Hartford, CT: Brown and Gross, 1867), 129.

segment was dedicated to the inhalation of laughing gas.[274] Mr. Henry showcased laughing gas at this performance at the Adelphi in 1824 and continued these performances until at least 1829. Henry also sold booklets at his performances in which he discussed laughing gas and other novel experiments.

Mr. Henry's shows created enough of a stir to elicit an editorial response by an outraged chemist which was reprinted in the *American Mechanics Magazine* in March of 1825. The author, calling himself "Anti-Dram," implies that Henry was the first to coin the term "laughing gas". Anti-Dram expressed outrage that the British government would openly allow what he deemed to be public intoxication.

> I, for one, am much surprised that it [the British government] should permit this exhibition by Mr. Henry; and can only account for its negligence, by supposing that it is not so learned in chemistry as it is in morality and theology, and is ignorant that what he calls the *laughing gas* is a fluid, which, at a small expense, produces a most delightful, though transient state of intoxication. The exhibitor probably had an eye to concealment when he called it *laughing gas*.[275]

This appears to be the first time that the term "laughing gas" was used in print in North America. Even though the term laughing gas was here introduced to the American reading public, it was not used in advertisements in North America until the 1840s, and Colton was the person to bring the term into common use. In contrast with earlier exhibitors of the gas who referred to the

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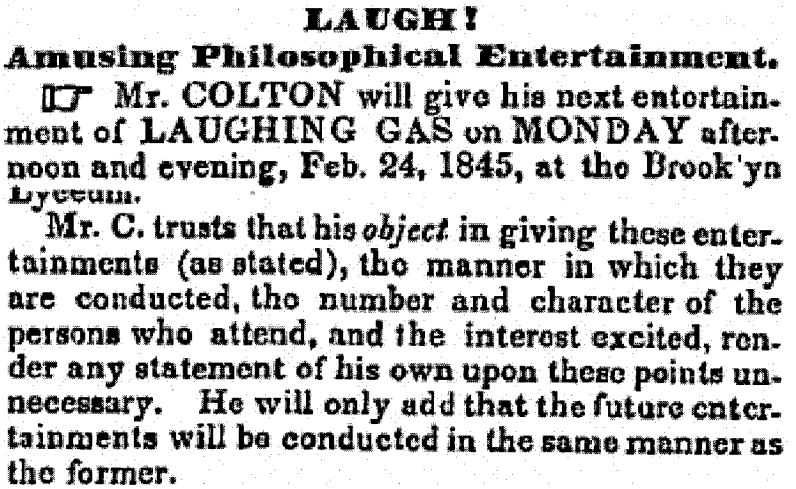
[274] Reproduced in Edwin A. Dawes, *The Great Illusionists* (Newton Abbot, UK: David & Charles, 1979), 75.

[275] Anti-Dram, "Cheap Drunkenness," *American Mechanics Magazine* 1, no. 7 (1825): 107. Emphasis in original.

substance as either "nitrous oxide" or "the exhilarating air", Colton always referred to the substance he was administering as laughing gas [figure 19].[276]



LAUGH!
Amusing Philosophical Entertainment.

☞ Mr. COLTON will give his next entertainment of LAUGHING GAS on MONDAY afternoon and evening, Feb. 24, 1845, at the Brook'yn Lyceum.

Mr. C. trusts that his *object* in giving these entertainments (as stated), the manner in which they are conducted, the number and character of the persons who attend, and the interest excited, render any statement of his own upon these points unnecessary. He will only add that the future entertainments will be conducted in the same manner as the former.

Figure 18. Colton presents Laughing Gas, an Amusing Philosophical Entertainment. Classified advertisement *Brooklyn Daily Eagle* 2 February 1845, p. 2.

In both his 1840s and 1860s series of lectures and exhibitions, Colton invariably called that which he was exhibiting laughing gas. In contrast, in his Colton Dental Association advertisements, Colton often referred to the substance he was administering as nitrous oxide. This allowed Colton during the 1860s to separate out in the public mind the substance which was used for amusement from the substance which was used to quell pain in tooth extractions. It didn't matter that these substances were chemically the same. Because they were used in different contexts, Colton established each with separate identities and social functions.

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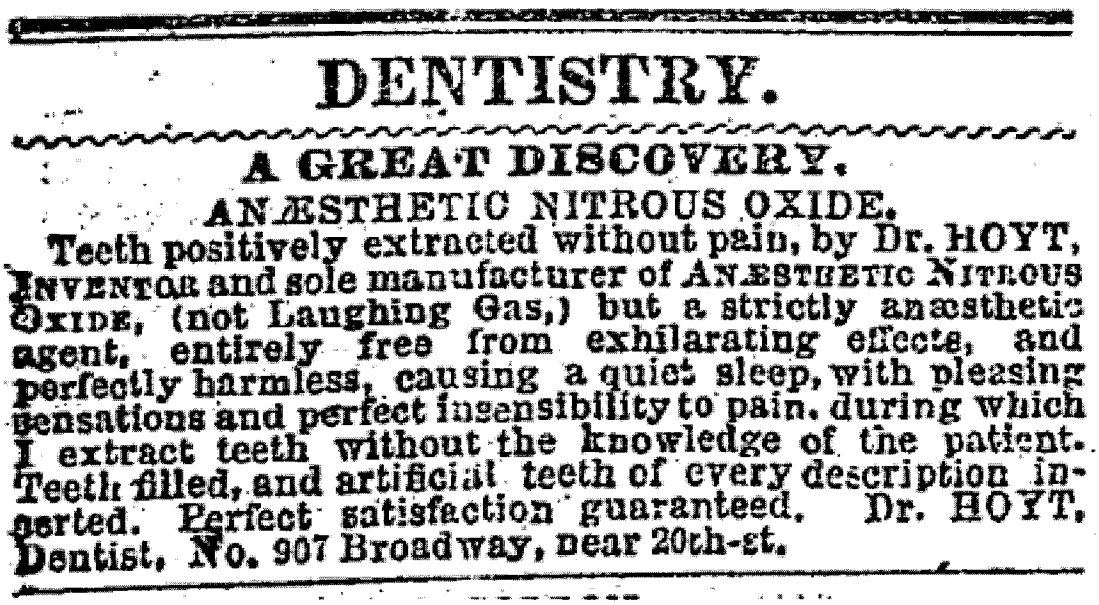
[276] See Chapter 3 for more information about nitrous oxide use earlier in the Nineteenth-Century. Before 1850, it was sometimes referred to as "exhilarating air," but most simply called it nitrous oxide.

This distinction between laughing gas and nitrous oxide was made even more explicit when one of Colton's competitors in New York City, dentist Dr. Hoyt, produced a series of advertisements implying that the nitrous oxide that he used for anesthesia in dental surgeries was somehow a different substance than the laughing gas which was used to amuse and entertain [figure 20].



DENTISTRY.

A GREAT DISCOVERY.

ANÆSTHETIC NITROUS OXIDE.

Teeth positively extracted without pain, by Dr. HOYT, INVENTOR and sole manufacturer of ANÆSTHETIC NITROUS OXIDE, (not Laughing Gas,) but a strictly anæsthetic agent, entirely free from exhilarating effects, and perfectly harmless, causing a quiet sleep, with pleasing sensations and perfect insensibility to pain, during which I extract teeth without the knowledge of the patient. Teeth filled, and artificial teeth of every description inserted. Perfect satisfaction guaranteed. Dr. HOYT, Dentist, No. 907 Broadway, near 20th-st.

Figure 19. Hoyt advertisement for "Anaesthetic Nitrous Oxide." Classified advertisement *New York Times* 25 November 1863 p. 7.

Hoyt claims to have invented "anaesthetic nitrous oxide," something altogether different from the laughing gas which was known to exhilarate. This short lived advertising campaign shows how it was essential that separate terminology be developed for use within different social and physical contexts. In order for nitrous oxide to be used in medical context, it had to be disassociated from the amusing contexts of laughing gas displays.

Once Colton had moved to the Cooper Institute, he began a blitz of an advertising campaign. From 1864 to 1866, Colton placed 416 advertisements for the Colton Dental Association in the *New York Times.*[277] He also gave 13 lectures on the effects of laughing gas at the Cooper Institute during this period. Colton melded both of his endeavors, promoting the safety and utility of the gas during his laughing gas exhibitions while continuing to extract teeth at the Colton Dental Association.

Though his efforts, Colton was able to generate enough interest in the gas to prompt experimentation in the context of more serious general surgical procedures. The Philadelphia newspaper *Christian Recorder* reported on 4 November 1865 that the Pennsylvania Hospital had experimented successfully with nitrous oxide in serious operations. The success was so complete that the hospital announced that they would use nitrous oxide exclusively for all surgical operations, dismissing both ether and chloroform.[278] In January of 1866, Dr. J. M. Carnochan, chief of staff at the New York State Emigrant Hospital, performed three operations on patients, including the removal of a cancerous breast, while they were under the influence of nitrous oxide, and four more in February of the same year. Carnochan stated that he believed nitrous oxide to be far superior to both ether and chloroform for surgical procedures.[279]

By the year 1867, Colton had turned the Colton Dental Association into a franchise. His practice expanded into Boston, Philadelphia, and Baltimore, St. Louis, Cincinnati, and

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[277] *New York Times*, 1864-1866.

[278] "Nitrous Oxide as an Anaesthetic," *Christian Recorder* November 4, 1865, n.p.

[279] James McManus, *Notes on the History of Anaesthesia : The Wells Memorial Celebration at Hartford, 1894: Early Record of Dentists in Connecticut* (Hartford: Clark & Smith, 1896), 20-21.

Brooklyn.[280] All of these new locations promoted the use of nitrous oxide for tooth extractions, and prompted other dentists to try nitrous oxide in their practices. Thus during the mid-1860s, Colton managed to publicize nitrous oxide in the context of dentistry and surgery, prompting experimentation and use by a variety of medical practitioners in the United States.

Colton in Europe 1867-1868: the nitrous oxide evangelist

Colton was a relentless evangelist for the use of nitrous oxide as an anesthetic. Having achieved moderate success in the United States in prompting dentists and physicians to consider the efficacy of the substance in surgery, Colton decided to spend some time in Europe, hoping to allow for the gas to take a foothold in practice overseas. His European experience, in conjunction with events already underway in the United States, assured the final adoption of nitrous oxide as an anesthetic.

In 1867, Colton took leave of New York and the Colton Dental Association to travel to Europe and promote nitrous oxide anesthesia.[281] He set up a dental exhibit at the Paris Universal Exhibition in 1867. An American dentist, Thomas W. Evans, who resided in Paris, reviewed the dental exhibits at the exhibition and was especially interested in Colton's exhibit from the United States. Evans was one of the most successful and famous dentists in Europe. He alone was dentist to nearly all the royal families on the Continent. In his review of the Exhibition in Paris, he noted Colton's prior success in America and the new apparatus that he was promoting.

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[280] Truman Smith and P. W. Ellsworth, *An Inquiry into the Origin of Modern Anaesthesia* (Hartford, CT: Brown and Gross, 1867), 75.

[281] Laird W Nevius, *The Discovery of Modern Anaesthesia: By Whom Was It Made? A Brief Statement of Facts* (New York City: George W. Nevius, Cooper Institute, 1894), 97.

> I have observed in the United States Collection in the Exposition of the *Société de Secours aux blesses* an apparatus for the production and administration of nitrous oxyde gas, exhibited by Dr. J. [sic.] Q. Colton of New York... Dr. Colton has re-established by thousands of experiments the superiority of the protoxyde of nitrogen gas over other anaesthetics in Dental Surgery, particularly in operations which may be promptly effected.[282]

Evans turned out to be an enthusiastic supporter of Colton and the use of nitrous oxide as an anesthetic. Evans immediately began his own series of experiments on the gas and took it upon himself to introduce the use of nitrous oxide in dental surgery across Europe.[283]

Evans befriended Colton, and agreed to introduce him to the London medical scene. Colton, after a brief trip home to America, returned with his wife and son to Paris on May 9, 1868 and met up with Evans. From there they traveled to London in June, where Evans introduced Colton to a number of dentists and physicians. It was agreed that while in London Colton would stay with dentist C. J. Fox. Fox spoke highly of Colton, mentioning his "pleasant stay" at Fox's home.

> ...permit me to here say that it is not easy to live for a week with a man without discovering whether he *is* or is *not* a man of truth, and straightforward unequivocal honesty. That Dr. Colton is such a man, I firmly believe.[284]

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[282] Thomas W. Evans, "Report Upon Dental Surgery and the Material Which It Employs," in *Paris Universal Exhibition, 1867* (Paris: Class XI, Group II, 1868). Quoted in W. D. A. Smith, *Under the Influence: A History of Nitrous Oxide and Oxygen Anaesthesia* (London: Macmillan Publishers, 1982), 76-77.

[283] Letter by Thomas W. Evans from Paris to the Odontological Society of Great Britain dated 5 April 1868. Quoted in W. D. A. Smith, *Under the Influence: A History of Nitrous Oxide and Oxygen Anaesthesia* (London: Macmillan Publishers, 1982), 97.

[284] C. J. Fox, *British Journal of Dental Science* 11 (1868): 138. Emphasis in original.

Colton's stay with Fox was not just a casual visit. Fox arranged for Colton to lecture to his medically inclined associates and demonstrate nitrous oxide at his house, followed by a busy schedule of demonstrating the gas to various professionals.

> On Friday, June 5th, Dr. Colton addressed a meeting of medical men and dentists at the house of Mr. C. J. Fox, detailing the history of the gas, and relating his experiences in over 27,000 cases. He then administered the gas to four patients with complete success; he repeated his address to another meeting on Wednesday, June 10th, and operated on nine patients for the extraction of teeth... He has administered the gas daily at the Dental Hospital to several patients; and on Monday evening met the Committee appointed by the Odontological Society to investigate the gas.[285]

Colton's visit prompted a flurry of publications about nitrous oxide anesthesia in Britain.[286] Upon his return to the United States, Colton wrote a letter to the *British Journal of Dental Science*

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[285] "Dr. Colton on Protoxide of Nitrogen," *British Medical Journal* 1 (1868): 594.

[286] "Nitrous Oxide as an Anesthetic," *Lancet* 92, no. 2363 (1868): 779-780, Joseph T. Clover, "The Administration of Nitrous Oxide and as Anaesthetic," *British Medical Journal* 2 (1868): 201, Joseph T. Clover, "Anaesthesia in Dentistry by Protoxide of Nitrogen," *British Medical Journal* 1 (1868): 338, Joseph T. Clover, "On the Administration of Nitrous Oxide," *British Medical Journal* 2 (1868): 491, Joseph T. Clover, "The Protoxide of Nitrogen as an Anaesthetic," *British Medical Journal* 1 (1868): 437, Alfred Coleman, "Action of Nitrous Oxide," *British Medical Journal* 1 (1868): 410, Alfred Coleman, "Mr. Coleman's Economizing Apparatus for Re-Inhaling the Gas," *British Journal of Dental Science* 12 (1869): 443, Alfred Coleman, "Re-Inhalation of Nitrous Oxide," *British Medical Journal* 2 (1868): 114, Thomas W. Evans, "Physiological Action of Nitrous Oxide," *Dental Cosmos* 11 (1869): 449, Thomas W. Evans, "Protoxide of Nitrogen," *British Journal of Dental Science* 11 (1868): 382, C. J. Fox, "On Nitrous Oxide," *British Journal of Dental Science* 11 (1868): 519, C. J. Fox, "On Nitrous Oxide in General Surgery," *British Journal of Dental Science* 11 (1868): 601, C. J. Fox, "On the Manufacture of Nitrous Oxide," *British Medical Journal* 2 (1868): 201, C. J. Fox, "On the Use of Nitrous Oxide Gas as Anaesthetic in Surgery, with Coxeter's Liquid Gas," *Lancet* 95, no. 2431 & 2432 (1870): 515.

explaining in detail his methods of administering the gas, reviewing what he had demonstrated during his stay in London. In his letter, Colton described the necessary steps to achieve successful anesthetization.

> First. Use a mouth-piece which has an aperture of a full half inch to breathe through; and five eights is better. Second. Instruct the patient to take full, deep, and slow inspirations of the gas, and hold the lips and the nose so as to allow *no particle of common air to enter and dilute the gas*... Third. Have the patient sit in nearly an upright position, or, at any rate, with the head leaning a little forward, and *keep the head there* while the gas is being breathed. When the patient is asleep, the head can fall back for operation.[287]

Colton had always insisted that the nitrous oxide must be given totally pure, without any contamination from common air. As Andrews had found in 1864, this seemed to prohibit longer surgical operations. In 1868, Andrews decided to experiment with a combination of oxygen and nitrous oxide for anesthesia. He had heard of a dentist in Chicago, Dr. Rogers, who had been using a nitrous oxide-oxygen combination for several years with great success. This prompted Andrews to do some experiments on rats. He found that with pure nitrous oxide the rat suffocated in ten minutes, but with a 25% oxygen 75% nitrous oxide combination, the rat lived for thirty minutes and recovered from its anesthetic stupor. Andrews published his results, prompting research into the nitrous oxide-oxygen combination for anesthesia.[288]

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[287] Gardner Quincy Colton, "Experience in the Use of Nitrous Oxide Gas," *British Journal of Dental Science* 11 (1868): 253. Emphasis in original.

[288] Edmund Andrews, "The Oxygen Mixture, a New Anaesthetic Combination," *Chicago Medical Examiner* 9 (1868): 656-661, H. M. Lilly, "Oxygen and Nitrous Oxide Mixture," *British Journal of Dental Science* 12 (1869): 99.

1868 turned out to be the miracle year for nitrous oxide anesthesia. Several key factors fell into place to assure that the gas would be used for a wide variety of surgeries. Colton had introduced the gas into dental practice in both North America and Europe, prompting interest on the part of medical practitioners. Andrews research prompted exploration into the nitrous oxide-oxygen combination, which was safer for long operations than pure nitrous oxide. Sprague, the Boston chemist, managed to produce a new inhaler that Colton in America and Fox in London both endorsed and used in their practices.[289] In London, Colton's visit had been the catalyst for new ideas on the storage and administration of nitrous oxide. A major advance was the idea of storing liquefied nitrous oxide in pressurized iron bottles, for simplicity of storage.[290] Not since 1800 had so much attention been paid to the substance. 1868 was the beginning of nitrous oxide being accepted as a medicinal substance with utility in surgical procedures.

The show must go on

As Colton began to achieve some success in his attempts to see nitrous oxide adopted as an anesthetic in medical circles, his laughing gas exhibitions took on a greater sense of theatricality and spectacle. During the 1860s and 1870s, Colton seemed to adopt even more of the showmanship techniques of his acquaintance P. T. Barnum than he had for his 1840s

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[289] Gardner Quincy Colton, "Experience in the Use of Nitrous Oxide Gas," *British Journal of Dental Science* 11 (1868): 251-257, C. J. Fox, *British Journal of Dental Science* 11 (1868): 138.

[290] "Liquefying Laughing Gas," *Chicago Medical Examiner* 9, no. 10 (1868): 620, C. J. Fox, "On the Use of Nitrous Oxide Gas as Anaesthetic in Surgery, with Coxeter's Liquid Gas," *Lancet* 95, no. 2431 & 2432 (1870): 479-480 & 515-517.

laughing gas lectures. That Barnum was the notorious master of Nineteenth-Century exhibition goes without saying. His advertising and display techniques served as blueprints for later entertainment industries such as vaudeville and the early motion picture industry.[291] This final section focuses on comparing the way that Colton displayed laughing gas with how Barnum displayed his attractions. Barnum and Colton both incorporated technological novelties as attractions, focusing on how their displays provided useful knowledge. From the beginnings of their careers, both emphasized moral entertainment, and in so doing specifically serviced the middle class. Both also then focused more on the emergent culture of exhibition by displaying physical or psychological oddities, again helping the middle class define itself in terms of what it was not. Simultaneously products and producers of the culture of exhibition, Barnum and Colton each in their own way helped to construct and reinforce the middle class sense of self during the Nineteenth-Century.

Useful knowledge was knowledge that would enrich the mind of the individual with scientifically and technologically pertinent information while simultaneously maintaining moral thought and behavior.[292] Barnum perpetuated useful knowledge by displaying technological

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[291] For general readings on the cultural work of Barnum, cf. Bluford Adams, *E Pluribus Barnum: The Great Showman and the Making of U.S. Popular Culture.* (Minneapolis: University of Minnesota Press, 1997), James W. Cook, *The Arts of Deception: Playing with Fraud in the Age of Barnum.* (Cambridge, MA: Harvard University Press, 2001), Andrea Stulman Dennett, *Weird and Wonderful: The Dime Museum in America* (New York: New York University Press, 1997), Neil Harris, *Humbug: The Art of P.T. Barnum*, Phoenix ed. (Chicago: University of Chicago Press, 1981).

[292] For "useful knowledge," an idea introduced at the turn of the Nineteenth-Century, cf. William T. Alderson et al., eds., *Mermaids, Mummies, and Mastodons: The Emergence of the American Museum.* (Washington, D.C.: American Association of Museums, 1992), Toby A. Appel, "Science, Popular Culture

novelties mid-century in his American Museum and at the Crystal Palace in New York. One particular event at the Crystal Palace in 1854 demonstrated Barnum's knack at taking a technological innovation and making it an entertaining spectacle. Elisha Graves Otis was having difficulty generating interest in his new safety elevator, so Barnum let him build a 300 foot tall structure in the center of the main exhibition hall in order to demonstrate the device. Otis stood on the elevator platform, along with some heavy barrels and crates, and ascended. Once he had reached the top, Otis commanded his assistant to cut the rope holding the elevator. The assembled crowd was aghast; Otis would surely plummet to his death. The rope was cut and Otis fell for a second, then abruptly stopped. The audience gasped, then cheered. Otis performed a gentlemanly bow and stated, "All safe, gentlemen, all safe."[293] This was the sort of technological drama that Barnum reveled in; introducing a modern innovation to an eager audience in the most dramatic and entertaining way possible.

During the 1840s, Colton seemed especially adept at appealing to the role that "useful knowledge" played in his exhibitions. He emphasized in his early advertisements that the entertainment would be scientific and instructive, not just diversionary. An 1845 advertisement from the *New York Tribune* stated that, "Mr. C. will treat the subject of the *Nitrous Oxide* or *Laughing Gas* in a scientific manner, and endeavor to make it *instructive* as well as amusing."[294] In the same period, Colton also added some additional technological attractions to his laughing

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and Profit: Peale's Philadelphia Museum," *Journal of the Society for the Bibliography of Natural History* 9 (1980): 619-634.

[293] David Lindsay, *Madness in the Making: The Triumphant Rise and Untimely Fall of America's Show Inventors* (New York: Kodansha International, 1997), 127-129.

[294] "Classified Advertisement," *New York Tribune* December 19, 1845, 3. Emphasis in original.

gas entertainments when he displayed the effects of galvanism on dead animals, demonstrated the telegraph, and introduced the first electric motor. Both Barnum and Colton saw the advantage of characterizing their entertainments as having redeeming intellectual value, bestowing upon audience members knowledge of technological and scientific novelties.

Barnum saw the similarities between entertaining and religious expression, noticing a parallel between his American Museum and church going as social phenomena.[295] Barnum exploited this analogy by making the lecture room at the American Museum a locus for instruction in proper moral behavior during the 1840s and 1850s [Figure 21]. Temperance plays and plays about slavery were especially useful in demonstrating to their middle class audiences proper public behavior and private sentiment.[296] By putting on plays in his lecture room that stressed moral behavior to their audiences, Barnum was able to target middle class values and provide a safe location for ennobling theatrics during a period when the popular theater was becoming the locus of immoral behavior.

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[295] A. Anderson, *Snake Oil, Hustlers and Hambones: The American Medicine Show.* (Jefferson, NC: McFarland & Company, 2000), 18.

[296] Bluford Adams, *E Pluribus Barnum: The Great Showman and the Making of U.S. Popular Culture.* (Minneapolis: University of Minnesota Press, 1997), 116-163.

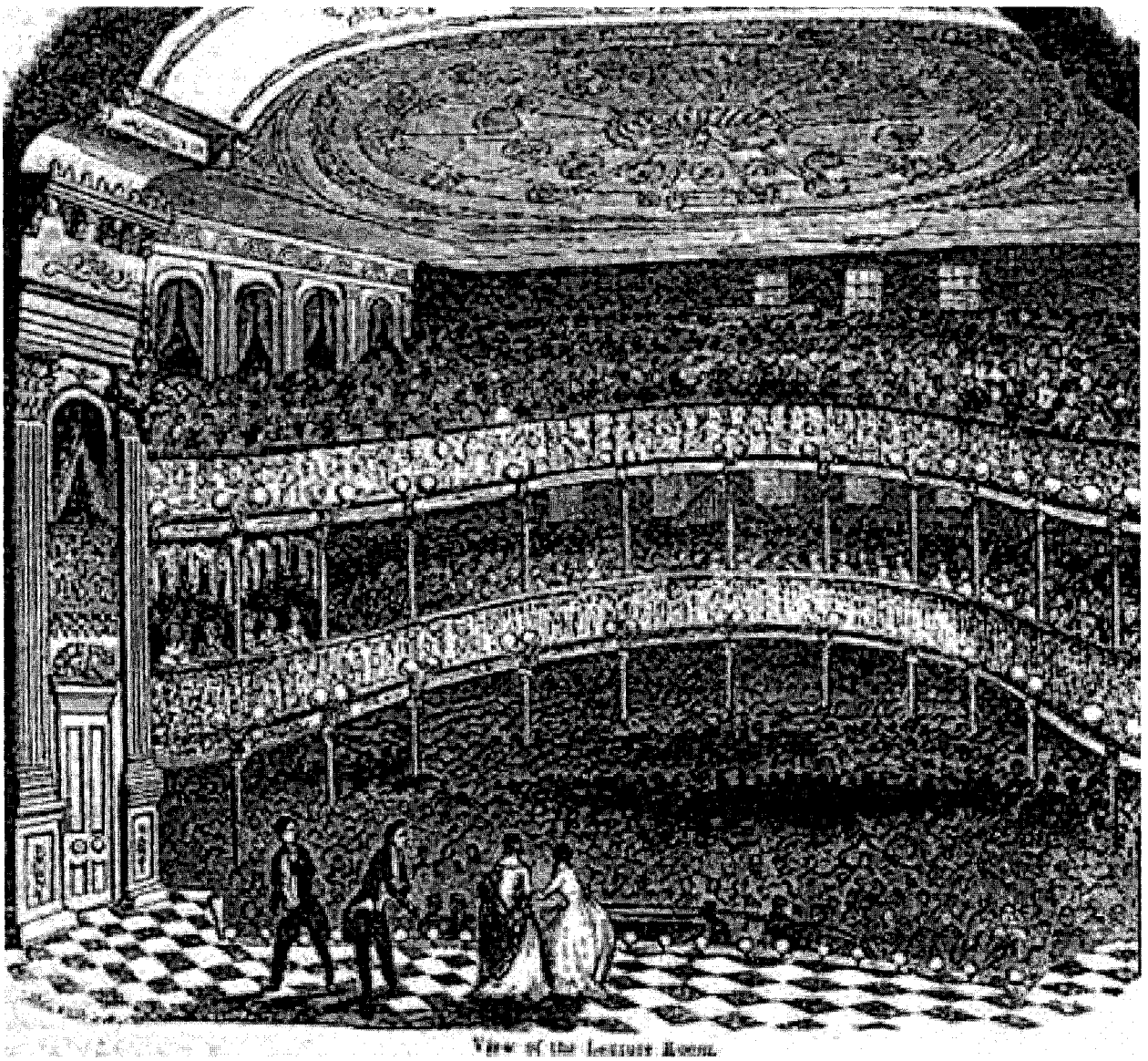

Figure 20 Barnum's lecture hall at the American Museum. Notice the incredible audience capacity.[297] Courtesy of the Lost Museum Archive.

Colton made certain that his advertisements gave the impression that his entertainments were targeted towards the emerging middle class when he proclaimed, "None but gentlemen of

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[297] P. T. Barnum, *American Museum Illustrated Guide Book* (New York: P.T. Barnum, 1850), 30.

the first respectability will be allowed to inhale the gas."[298] He always emphasized that his entertainments were rational entertainments, and scheduled events appropriate for children and ladies. In 1848, Colton exhibited a painting by Rembrandt Peale, "The Court of Death," alongside his laughing gas show in Mobile, Alabama. This moralistic painting was thirteen feet high and twenty four feet wide, a spectacle in its own right [figure 22].

Figure 21. Rembrandt Peale's 1820 painting "The Court of Death." The old man in the foreground approaches Death, but he is held up by Hope. Courtesy of the Detroit Institute of the Arts.

This impressive canvas reminded those who viewed it that in the end all would be judged on their moral constitutions and behaviors. The combination of the moral lessons of the "Court of

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[298] "Classified Advertisement," *New York Tribune* December 24, 1844, 3.

Death" and the moral self revealed by laughing gas highlighted how the middle class learned to construct themselves in terms of sincerity and moral righteousness.

By the 1860s, Barnum and Colton had both shifted the emphasis in their displays. American culture had changed, and their shows moved to both reflect and service these changes. As discussed earlier in Chapter 3, Colton's lectures during the 1840s had performed the function of revealing inner character at a point in American history when individuals were having difficulty distinguishing between the genuinely sincere citizen and the villainous confidence man. Whereas prior to 1850 Americans had relied on sincerity in behavior and dress to regulate social interaction, after mid-century theatricality and individuality emerged as the determinants of proper social positioning.[299] Both Barnum and Colton adjusted their presentations in order to reinforce and expand the culture of theatricality, while still managing the barriers between social classes by dictating criteria for inclusion in the middle class.

The best example of how Barnum serviced the ideals of the middle class was through his "What is It?" exhibit. This exhibit was a blatant display of otherness in the form of an African American who took the role of a liminal creature, something nearly animal but nearly man. This exhibit appealed to all classes of white Americans, not just the middle class. It helped to define a sense of self by contrasting it with that of an obvious other [figure 9].

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[299] Karen Halttunen, *Confidence Men and Painted Women: A Study of Middle-Class Culture in America, 1830-1870* (New Haven, CT: Yale University Press, 1982), 182-190.

Figure 22. "What is it?" advertising placard, illustrated by Currier and Ives for their friend, Barnum. Notice how the respectable middle class citizens look on the exhibit with nonchalance, secure in their own social standing. Courtesy of the New York Historical Society.

Barnum's What is it? introduced explicitly into American culture the idea of the "nondescript," something which defies definition and requires for its categorization the input of observers. James Cook mentioned the importance of the emergence of the term nondescript in conjunction with the What is it? exhibit. The term changed from an adjective meaning something which is not yet described to a noun referring to a person or thing of no class or kind, something that

resists classification or straddles descriptive boundaries.[300] As we have seen, a reoccurring problem of the middle class was that of self-identification.[301] Just because one looks the part and acts the part of middle class propriety does not mean that he is a legitimate member of the class and not an imposter. Barnum's What is it? exhibit allowed Americans to safely play with the construction of categories and social boundaries by applying to "It" degrees of animality and/or humanity, in contrast with simple binary categories such as Man/animal. It smiled and wore clothing with ease. Yet It was so different from Barnum's patrons. The What is It? Exhibit offered middle class patrons a chance to safely explore and participate in the construction of race, emphasizing that such constructions were indeed subject to social trends and personal comfort.

Barnum's influence on Colton's use of the nondescript can first be seen in Colton's early laughing gas shows of the 1860s. For Colton's return to lecturing, Barnum lent him the use of his newest attraction, Commodore Nutt [figure 23].

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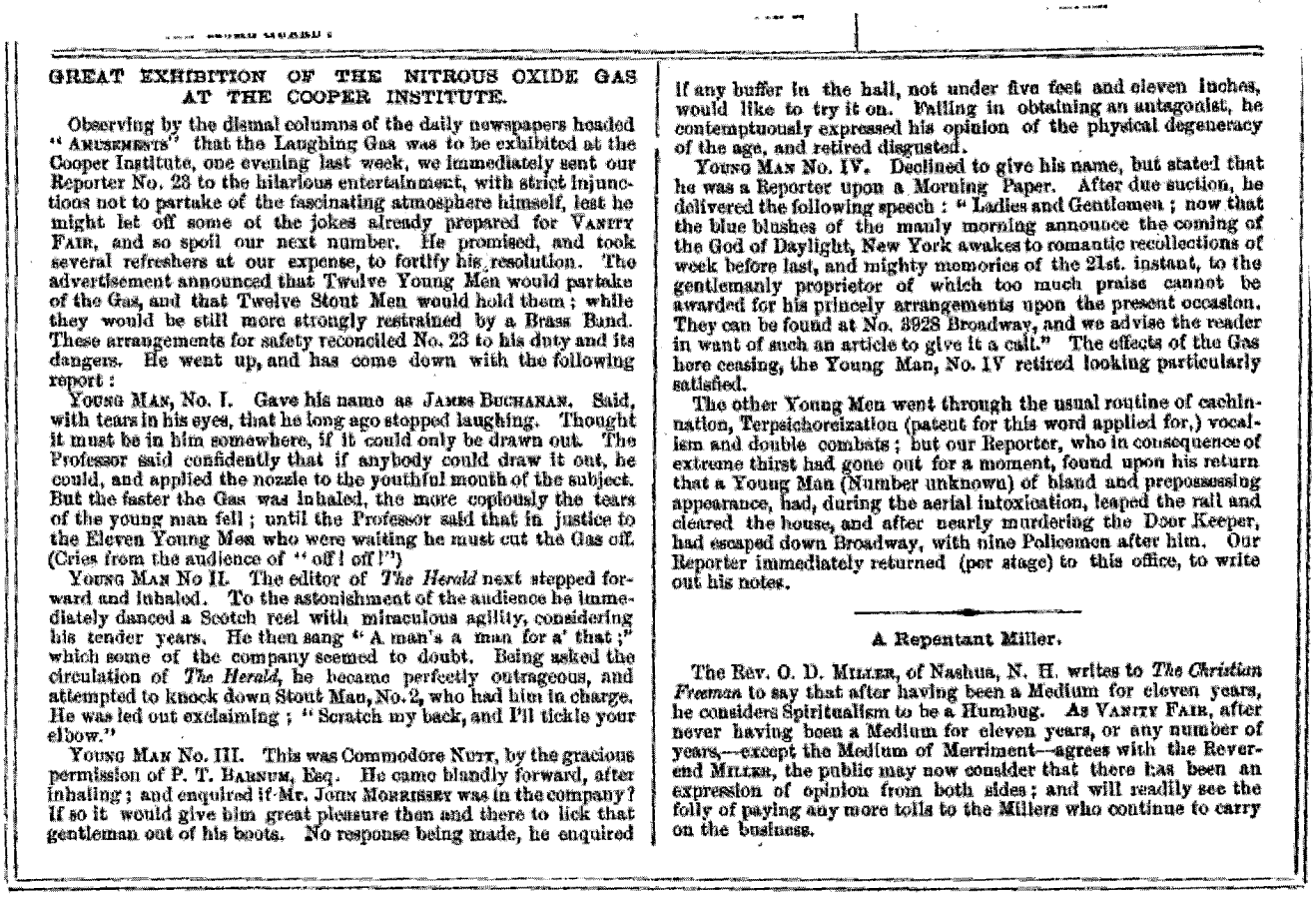
[300] James W. Cook, *The Arts of Deception: Playing with Fraud in the Age of Barnum.* (Cambridge, MA: Harvard University Press, 2001), 134.

[301] Karen Halttunen, *Confidence Men and Painted Women: A Study of Middle-Class Culture in America, 1830-1870* (New Haven, CT: Yale University Press, 1982), 1-32.



GREAT EXHIBITION OF THE NITROUS OXIDE GAS AT THE COOPER INSTITUTE.

Observing by the dismal columns of the daily newspapers headed "AMUSEMENTS" that the Laughing Gas was to be exhibited at the Cooper Institute, one evening last week, we immediately sent our Reporter No. 23 to the hilarious entertainment, with strict injunctions not to partake of the fascinating atmosphere himself, lest he might let off some of the jokes already prepared for VANITY FAIR, and so spoil our next number. He promised, and took several refreshers at our expense, to fortify his resolution. The advertisement announced that Twelve Young Men would partake of the Gas, and that Twelve Stout Men would hold them; while they would be still more strongly restrained by a Brass Band. These arrangements for safety reconciled No. 23 to his duty and its dangers. He went up, and has come down with the following report:

YOUNG MAN, No. I. Gave his name as JAMES BUCHANAN. Said, with tears in his eyes, that he long ago stopped laughing. Thought it must be in him somewhere, if it could only be drawn out. The Professor said confidently that if anybody could draw it out, he could, and applied the nozzle to the youthful mouth of the subject. But the faster the Gas was inhaled, the more copiously the tears of the young man fell; until the Professor said that in justice to the Eleven Young Men who were waiting he must cut the Gas off. (Cries from the audience of "off! off!")

YOUNG MAN NO II. The editor of *The Herald* next stepped forward and inhaled. To the astonishment of the audience he immediately danced a Scotch reel with miraculous agility, considering his tender years. He then sang "A man's a man for a' that;" which some of the company seemed to doubt. Being asked the circulation of *The Herald*, he became perfectly outrageous, and attempted to knock down Stout Man, No. 2, who had him in charge. He was led out exclaiming; "Scratch my back, and I'll tickle your elbow."

YOUNG MAN No. III. This was Commodore NUTT, by the gracious permission of P. T. BARNUM, Esq. He came blandly forward, after inhaling; and enquired if Mr. JOHN MORRISSEY was in the company? If so it would give him great pleasure then and there to lick that gentleman out of his boots. No response being made, he enquired if any buffer in the hall, not under five feet and eleven inches, would like to try it on. Failing in obtaining an antagonist, he contemptuously expressed his opinion of the physical degeneracy of the age, and retired disgusted.

YOUNG MAN No. IV. Declined to give his name, but stated that he was a Reporter upon a Morning Paper. After due suction, he delivered the following speech: "Ladies and Gentlemen; now that the blue blushes of the manly morning announce the coming of the God of Daylight, New York awakes to romantic recollections of week before last, and mighty memories of the 21st. instant, to the gentlemanly proprietor of which too much praise cannot be awarded for his princely arrangements upon the present occasion. They can be found at No. 3928 Broadway, and we advise the reader in want of such an article to give it a call." The effects of the Gas here ceasing, the Young Man, No. IV retired looking particularly satisfied.

The other Young Men went through the usual routine of cachinnation, Terpsichoreization (patent for this word applied for,) vocalism and double combats; but our Reporter, who in consequence of extreme thirst had gone out for a moment, found upon his return that a Young Man (Number unknown) of bland and prepossessing appearance, had, during the aerial intoxication, leaped the rail and cleared the house, and after nearly murdering the Door Keeper, had escaped down Broadway, with nine Policemen after him. Our Reporter immediately returned (per stage) to this office, to write out his notes.

A Repentant Miller.

The Rev. O. D. MILLER, of Nashua, N. H. writes to *The Christian Freeman* to say that after having been a Medium for eleven years, he considers Spiritualism to be a Humbug. As VANITY FAIR, after never having been a Medium for eleven years, or any number of years,—except the Medium of Merriment—agrees with the Reverend MILLER, the public may now consider that there has been an expression of opinion from both sides; and will readily see the folly of paying any more tolls to the Millers who continue to carry on the business.

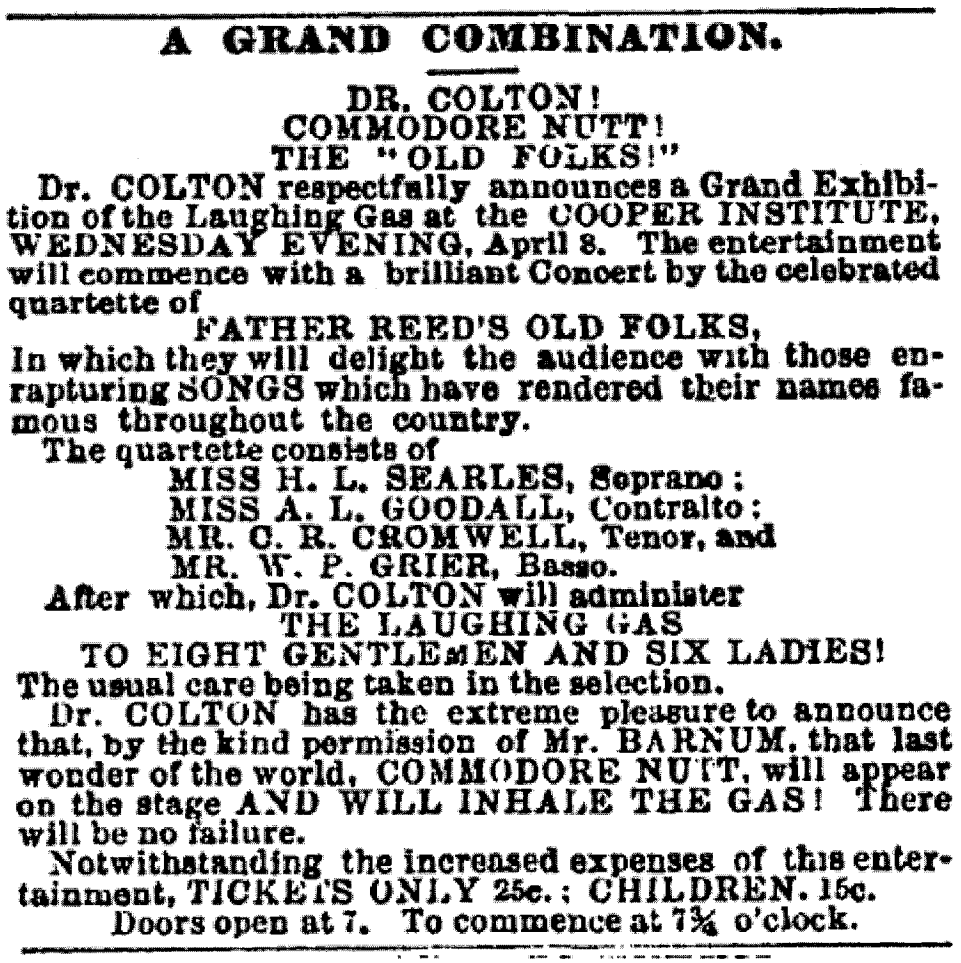
Figure 23. An article reviewing Colton's laughing gas show at the Cooper Institute. Young Man No. III was Commodore Nutt, and his reactions to the gas were not as expected. *Vanity Fair Magazine* 22 February 1862 p. 94.

Barnum had found Commodore Nutt, a dwarf even smaller than his earlier sensation Tom Thumb, in Manchester, New Hampshire. He procured the exclusive rights to exhibit Nutt for three years at the American Museum. For this privilege Barnum paid the enormous sum of $30,000.

Figure 24 The $30,000 Nutt., looking less than happy in this image from a newspaper advertisement. Barnum's typical sense of theatrical exaggeration in attempts to bring in an audience prevails. *New York Times*, February 9, 1863. p.3.

The fact that Barnum lent Commodore Nutt to Colton for his "comeback" show demonstrates Barnum had a profound respect for Colton and his ability to attract a crowd. Nutt was a physical oddity, and the assumption was that his behavior under the influence of laughing gas would only reinforce his otherness. Instead, Nutt's performance was bland by the reviewer's standards, ending with Nutt expressing disgust with his ironic condemnation of "the physical degeneracy of the age." Nutt had not behaved as expected; less the eyelash-batting charming

boy-man than the bitter world-worn actor, tired of yet again being asked to perform the same tired monologue. Still, Colton milked his use of Commodore Nutt several more times in New York during the spring of 1863, adding for extra entertainment (and in contrast with the surly Nutt) charming crooners, the "Old Folks" [figure 25].



A GRAND COMBINATION.

DR. COLTON!
COMMODORE NUTT!
THE "OLD FOLKS!"

Dr. COLTON respectfully announces a Grand Exhibition of the Laughing Gas at the COOPER INSTITUTE, WEDNESDAY EVENING, April 8. The entertainment will commence with a brilliant Concert by the celebrated quartette of

FATHER REED'S OLD FOLKS,

In which they will delight the audience with those enrapturing SONGS which have rendered their names famous throughout the country.

The quartette consists of

MISS H. L. SEARLES, Soprano;
MISS A. L. GOODALL, Contralto;
MR. C. R. CROMWELL, Tenor, and
MR. W. P. GRIER, Basso.

After which, Dr. COLTON will administer

THE LAUGHING GAS

TO EIGHT GENTLEMEN AND SIX LADIES!

The usual care being taken in the selection.

Dr. COLTON has the extreme pleasure to announce that, by the kind permission of Mr. BARNUM, that last wonder of the world, COMMODORE NUTT, will appear on the stage AND WILL INHALE THE GAS! There will be no failure.

Notwithstanding the increased expenses of this entertainment, TICKETS ONLY 25c.; CHILDREN, 15c.

Doors open at 7. To commence at 7¾ o'clock.

Figure 25. Colton presenting Laughing Gas, Commodore Nutt and Father Reed's Old Folks. Classified advertisement *New York Times* 6 April 1863 p. 7.

Colton reconstituted laughing gas exhibitions after 1860 as a type of nondescript display, one which served to re-legitimate preconceptions about character and class. Nitrous oxide exhibitions encouraged the sense of individual theatricality, and the variety of personalities accompanying such theatricality, that emerged in America after 1850. For those who inhaled the

gas publicly, it provided an opportunity to prove oneself a respectable citizen through stage theatrics. For those watching the nitrous oxide exhibition, they were afforded the chance to practice in the construction of social class and the defining of others. Although many of the inhalers on Colton's stage behaved in ways that were easily categorized in terms of class, others were not so easy to classify. These nondescript individuals may have looked exactly like typical audience members, but their behavior on the gas reveled some liminal or disturbing aspect of their personality, making them less easy to pigeonhole. When audience members negotiated and judged the position of individuals on Colton's stage, they were practicing the same sort of judgments that they were called upon to make more frequently on a daily basis in ordinary life. Colton's world was a microcosm of the larger middle class social universe. Just as Barnum through his exhibits initiated, "...a series of public conversations in which the potentially divisive issues of sectional politics, racial science, and social respectability began to serve as topics of popular amusement...,"[302] Colton served up the practice of class construction as an evening's entertainment.

Colton further blurred the line between appearance and reality by sharing the stage with a conjurer from 1873 to 1874. He and Professor Hartz put on a series of shows at the Cooper Institute [figure 27], followed by another series of shows at Robinson Hall.

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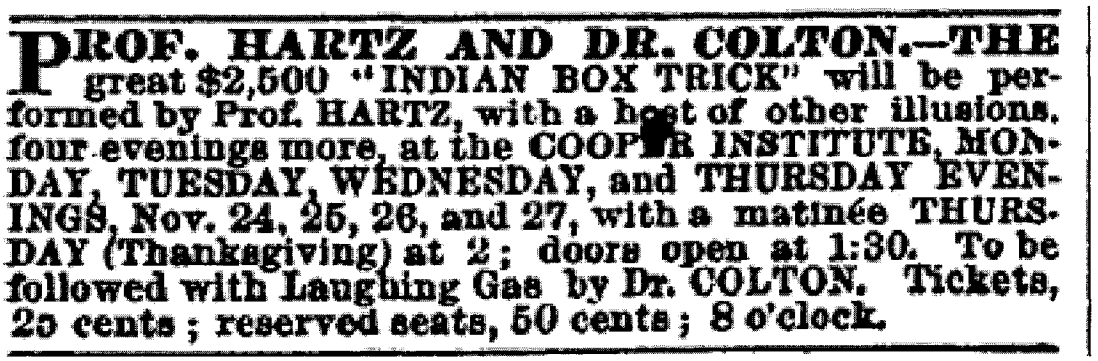
[302] James W. Cook, *The Arts of Deception: Playing with Fraud in the Age of Barnum.* (Cambridge, MA: Harvard University Press, 2001), 139.



PROF. HARTZ AND DR. COLTON.—THE great $2,500 "INDIAN BOX TRICK" will be performed by Prof. HARTZ, with a host of other illusions, four evenings more, at the COOPER INSTITUTE, MONDAY, TUESDAY, WEDNESDAY, and THURSDAY EVENINGS, Nov. 24, 25, 26, and 27, with a matinée THURSDAY (Thanksgiving) at 2; doors open at 1:30. To be followed with Laughing Gas by Dr. COLTON. Tickets, 25 cents; reserved seats, 50 cents; 8 o'clock.

Figure 26. Colton shares the stage for a series of shows with Professor Hartz, conjurer. Classified advertisement, *New York Times* 23 November 1873 p.7

Conjuring had undergone reform in the middle of the Nineteenth-Century, due primarily to the efforts of Jean-Eugene Robert-Houdin. Houdin made the art of deliberate deception respectable entertainment for the middle classes, divorcing it of the low carnival associations and links to immoral black magic that had haunted the art for the past two centuries. The modern magician, like Barnum and Colton, always took the stage in evening clothes, and portrayed himself as an honest liar. The combination of prestidigitation and laughing gas once again gained popularity, melding the arts of deception with the craft of exposure.[303]

Colton took his cues on advertising and exhibiting from his expert acquaintance Barnum, the man who systematically linked entertainment and deception during the Nineteenth-Century. Although he was not a trickster in the sense that Barnum, King of Humbugs, was, Colton had learned the value of publicity and showmanship from the Nineteenth-Century master, and in the process served to reinforce middle class values in the same way that Barnum's exhibitions did.

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[303] Laughing gas and conjuring went together as far back as 1824 London. Cf. Edwin A. Dawes, *The Great Illusionists* (Newton Abbot, UK: David & Charles, 1979), 73-78.

Colton believed, or at least presented in retrospect the image that he believed, that when he opened the Colton Dental Association, he was leaving the unpredictability of show business behind.

> This [extracting teeth] I thought was a better business than lecturing, often to "a miserable account of empty boxes", and determined me to come to New York, and establish an institution devoted exclusively to extracting teeth with the gas.[304]

However, Colton was never able, or perhaps never willing, to give up lecturing altogether. From 1862 until his death in 1898, Colton placed over 1500 advertisements for nitrous oxide in New York City, either in the form of lecture exhibitions, the Colton Dental Association, or both simultaneously.[305] The continued popularity of Colton's exhibitions shows that even after nitrous oxide was adopted as an anesthetic in dentistry, it still served other cultural functions. Even though he himself was earning a lucrative living by administering nitrous oxide to dental patients, he continued throughout the 1860s and 1870s to present laughing gas lectures, administering it to audience members for their amusement.

When Colton was 69 years old, he gave his last lecture on nitrous oxide at the Cooper Institute on 13 December 1883. This last presentation focused on the history and introduction of anesthesia, as Colton attempted to once again focus on the educational aspect of his presentations.

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[304] Gardner Quincy Colton, "Nitrous Oxide," *Monthly review of dental surgery* 2 (1873-74): 29.

[305] *New York Times* 1862-1898, *Brooklyn Daily Eagle* 1862-1898.

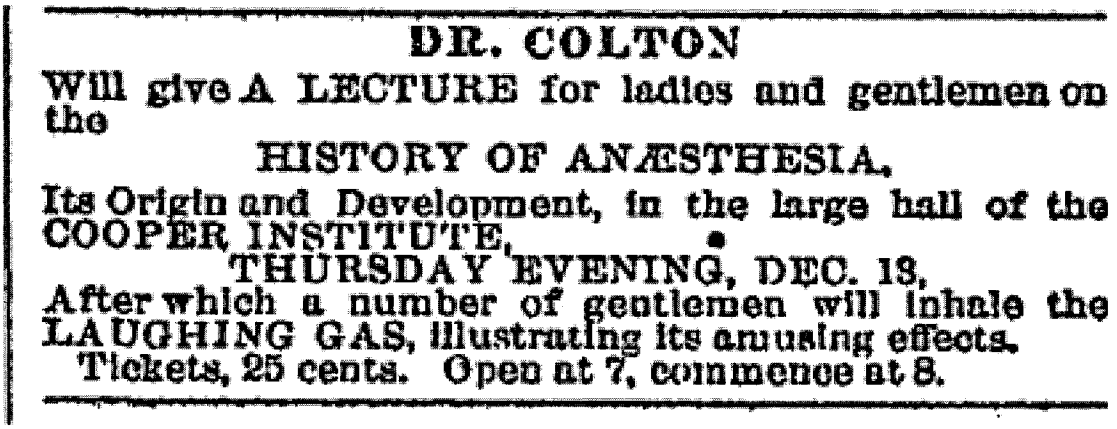
DR. COLTON
Will give A LECTURE for ladies and gentlemen on the
HISTORY OF ANÆSTHESIA,
Its Origin and Development, in the large hall of the COOPER INSTITUTE,
THURSDAY EVENING, DEC. 13,
After which a number of gentlemen will inhale the LAUGHING GAS, illustrating its amusing effects.
Tickets, 25 cents. Open at 7, commence at 8.

Figure 27. Colton's final lecture, on the history of anaesthesia. Classified advertisement *New York Times* 11 December 1883 p. 7.

Still, Colton was happy to present the laughing gas to ladies and gentlemen to inhale for their amusement, and the amusement of others in the audience [figure 28]. He continued to run the Colton Dental Association for many more years until it closed in 1895.[306] He claimed to have administered the gas to over 195,000 people at the Colton Dental Association from 1863 to 1895. He administered the gas to thousands more in the context of his laughing gas exhibitions. As a liminal figure couched in the space between showman and scientist, Colton negotiated a cultural niche for laughing gas while simultaneously outlining the utility of nitrous oxide in medicine. In the process, he emerged as a key yet heretofore historically unnoticed figure in Nineteenth-Century American medical and entertainment culture.

[306] "Advertisement - Not Dead!," *New York Times* October 12, 1895, 1.

Chapter 6. Wells' failure and Morton's success: the culture of chemicals

In this final chapter, I look more in depth at Wells' failure and Morton's success. First I examine what Wells and Morton's contemporaries believed about the respective failure and success of these demonstrations. Then I recall what some recent historians have said about the role these demonstrations played in the introduction of anesthesia. Modern historians such as Norman Bergman and Richard Wolfe invariably present Wells' failure as an intellectual precursor to modern anesthesia.[307] However they do not explain why Wells' initial demonstration failed, concentrating more on cataloging anesthesia's success stories, and glossing over the failures as missed opportunities. I argue that the results of both Wells' failure and Morton's success were negotiated by the participants, and that we can understand in detail both the failure and the success by understanding the unique epistemological positioning of nitrous oxide and ether during the mid-1840s. Finally, I will present my own novel arguments which explain Wells' failure and Morton's success, ones which focus on the unique historical character of nitrous oxide and ether, adding to the social analysis the material conditions which constrained these events.

Contemporary accounts

It would have been telling to examine what was published about Wells' failed demonstration after it occurred. This, however, is impossible since there were no published

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[307] Cf. Norman A. Bergman, *The Genesis of Surgical Anesthesia* (Park Ridge, IL: Wood Library-Museum of Anesthesiology, 1998), 176, Richard J. Wolfe, "Who Was the Discoverer of Surgical Anesthesia? A Brief for Horace Wells.," in *I Awaken to Glory: Essays Celebrating Horace Wells*, ed. Richard J. & Menczer Wolfe, Leonard F. (Boston: Boston Medical Library, 1994), 1-72.

reports of Wells' failed demonstration. In addition, there are no known first hand accounts of the demonstration dated at the time it occurred in January of 1845. Unlike the flurry of publications prompted by Morton's Letheon demonstrations, Wells failure was ignored in print, although it was apparently a notorious tale of failure repeated throughout the Boston medical community.[308] Still, this lack of attention generated by Wells' original experiment emphasizes the extent of its failure and the absolute deficiency of interest generated into nitrous oxide use in the medical community. It was only after Wells presented his claim to the invention of anesthesia through the early use of nitrous oxide that witnesses to his early nitrous oxide demonstration at the medical school began to make their first hand accounts of the event known. Once the controversy over the invention of anesthesia became heated and intense, individuals took sides with either Wells or Morton, and accounts of Wells' demonstration began to see the light of day. It is from these retrospective accounts, as well as the characterizations of the demonstration itself, that we have our first glimpses of the reasons attributed to Wells' failure.

Regional prejudice

Horace Wells studied dentistry in Boston from 1834-1836. Upon completion of his studies, he moved to Hartford, Connecticut and opened a dental practice that apparently turned out to be financially and intellectually rewarding. Despite his professional success in the city of Hartford, Wells was never a viable participant in the Boston medical scene and did not retain the contacts he had made during his early training. The fact that he remained on the fringe of the medical community is evidenced by his lack of publications, beyond a handful of self-published

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[308] For more on the notoriety of Wells' failure, see the previous chapter.

pamphlets. In 1838 he self-published his first pamphlet entitled *An Essay on Teeth.*[309] Funded entirely by Wells and his father-in-law, it was the first of any publication to recommend the consistent use of a tooth brush. Wells was either unwilling or unable to publish the contents of this pamphlet or his ideas about dental hygiene in any dental or medical journal. So although Wells was a successful professional dentist in the locality of Hartford, it appears that he was unknown outside of his adopted hometown.

James McManus believed that regional prejudice accounted for Wells' failure in Boston. He argued that the medical elite in Boston found it impossible to credit an unknown lowly outsider with the invention of such a cultural and medical magnitude as that of anesthesia.

> That a dentist from a country town could appear in Boston and announce to the world that he had made such a grand discovery was not to be credited, and Dr. Wells soon learned that not one of the influential medical or scientific men in that learned city could be induced to interest themselves in investigating the properties of the gas or lending him any assistance whatever while he remained in the city. They preferred to hiss and cry humbug rather than to give Dr. Wells a second chance to prove his discovery.[310]

McManus believed that this regional prejudice explained why Wells was ignored by medical men in Boston and why he was only given a single opportunity to present his discovery. Because he was an outsider, Wells did not possess the authority or social capital to even be presented with the opportunity to convince medical and scientific professionals that nitrous oxide could be useful in surgery. McManus was certain that had Wells been a member of the Boston medical

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[309] Horace Wells, *An Essay on Teeth; Comprising a Brief Description of Their Formation, Diseases, and Proper Treatment.* (Hartford, CT: Case, Tiffany & Co., 1838).

[310] James McManus, *Notes on the History of Anaesthesia : The Wells Memorial Celebration at Hartford, 1894: Early Record of Dentists in Connecticut* (Hartford: Clark & Smith, 1896).

community, other members of that community would have taken his claims seriously and his demonstration would have been a success.

> There is no doubt that if Dr. Wells had been a resident of Boston, an M .D., and a member of the staff of the Massachusetts General Hospital, his discovery in 1844 would have been quickly accepted.[311]

McManus concentrated on portraying Wells as a maverick crusader, advocating a revolutionary new technique, who was prejudicially rejected due to his outsider status. Although his explanation as to why Wells was never given a second chance after his initial failure is convincing, this does not completely explain why Wells' first demonstration was a failure. Part of this failure may be explained by Wells' outsider stance. He was not entering the classroom with the prestige or authority necessary to convince the medical students to take his claims seriously, and not merely as part of the evening's entertainment. As Bigelow recalled years later, Wells was merely a dentist, not worthy of he respect of medical students.

> [Wells] experiments were not "surgical operations," but only tooth pulling.[312]

However, let us not forget that at the time that Morton arranged for his Letheon demonstration, he too was considered to be an outsider by the surgeons at Massachusetts General Hospital. Morton, also known as a dentist and tooth-puller, was not in possession of an M.D., and was not on staff at the hospital like so many of the observers at his demonstration. Wells and Morton had more in common with each other than either had with the Boston medical community.

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[311] James McManus, *Notes on the History of Anaesthesia : The Wells Memorial Celebration at Hartford, 1894: Early Record of Dentists in Connecticut* (Hartford: Clark & Smith, 1896), 24.

[312] Henry Jacob Bigelow, "Nitrous Oxide Gas for Surgical Purposes in 1848.," *Boston Medical & Surgical Journal* 72 (1868): 143.

Although in all probability a contributory factor, Wells' failure cannot be explained solely by appealing to regional or professional prejudice, because Morton's success was achieved under similar prejudicial circumstances.

Wells was unprofessional

Opponents of Wells' claim that he invented anesthesia attacked Wells' credibility, implying that he had an unstable mind and was drawn to frivolous activities. While opening his practice in the late 1830s, Wells kept in his boarding house room several birds which he had trained to do simple tricks. Wells presented his trained birds to friends and associates as a curious hobby. But his birds were more to Wells then just objects of curiosity; Wells thought of his aviary fellows as his most intimate companions in Hartford. On 29 April 1837, Wells wrote to his sister about his socializing, emphasizing that his best friends were his birds.

> All the family that I have is 3 canary birds and one French Linnet which sings sweetly. I now have a splendid accordian [sic.] and when I commence playing the birds commence singing so we have fine concerts.[313]

Wells maintained this interest in birds throughout his lifetime. After his nitrous oxide demonstration in Boston failed and Wells took a hiatus from dental practice, he displayed his birds publicly in an attempt to earn some money. Wells' aviary interests, along with other interests in art and novelties, were criticized by Morton biographer Nathan P. Rice.

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[313] Wells in W. Harry Archer, "Life and Letters of Horace Wells, Discoverer of Anesthesia, Chronologically Arranged, with an Appendix.," *Journal of the American College of Dentists* 11, no. 2 (1944): 92.

Rice was commissioned to write a book supporting Morton's claims to have invented anesthesia. The result was *Trials of a Public Benefactor*, a 450 page effort published in 1858.[314] Rice offered evidence of Wells' "naturally-unsettled disposition" when he discussed Wells' various interests.

> At one period he was employed in manufacturing coal-sifters; at another in the exhibition of birds and other objects of natural history, or a panorama of some kind.[315]

Rice claimed that Wells was doomed to failure because he did not have a "scientific" mind, like Morton did. This sort of *ad hominim* attack on Wells' credibility tells us more about the vicious nature of the anesthesia debates than the reasons that Wells' failed to convince his audience in 1845 of the efficacy of nitrous oxide. Richard H. Dana took a similar stance against Wells in his 1848 account of the history of the invention of anesthesia. Dana also categorized Wells personality as flighty, emphasizing Wells' intellectual distance from the Boston medical community. He noted in a disparaging tone that Wells had become distracted from his scientific pursuits, preferring to exhibit his birds. "He had given up dentistry, and was engaged in conducting an exhibition of birds, which he said insured him of better health."[316] Bigelow, Morton's primary advocate on the surgical staff at Massachusetts General Hospital, also noted

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[314] Nathan P. Rice, *Trials of a Public Benefactor : As Illustrated in the Discovery of Etherization* (New York: Pudney & Russell, 1858). After Morton refused to pay Rice his agreed upon price for the production of the book, Rice wrote an article in support of Horace Wells. Nathan P. Rice, "A Grain of Wheat from a Bushel of Chaff.," *Knickerbocker, New-York Monthly Magazine* 3 (1859): 133-138.

[315] Nathan P. Rice, *Trials of a Public Benefactor : As Illustrated in the Discovery of Etherization* (New York: Pudney & Russell, 1858), 143.

[316] Richard H. Dana, "A History of the Ether Discovery. Report of the Massachusetts General Hospital," *Littell's Living Age*, no. 201 (1848): 567.

how Wells gave up his dental practice. He attributed it to discouragement after failing with nitrous oxide on so many occasions.

> In fact, Wells made so many notable failures that he abandoned the gas in disgust, and embarked in the picture and other business.[317]

Accounts such as these imply that at least part of Wells' failure was due to his own lack of professional integrity. Yet these revisionist tales are all constructed in retrospect, using information about Wells that was not available to his audience at the time he gave his nitrous oxide demonstration in Boston. As such, they could not have been reasons why his audience was not convinced of the efficacy of nitrous oxide.

Nitrous oxide non-effective

While Wells' social positioning and personal character were seen by some as reasons for his failure, others chose to attack his anesthetic agent of choice: nitrous oxide. Some of Wells' contemporaries argued that the primary reason his demonstration failed was that nitrous oxide did not in itself possess any inherent anesthetic properties. Those embroiled in the priority debates over anesthesia were especially quick to insist that nitrous oxide was not an anesthetic. What Wells claimed was insensitivity to pain was a simple loss of consciousness due to asphyxiation from lack of oxygen. It seemed obvious from the clinical signs of the patient that this was the case.

> The pulsations of the heart are often hard and vibratory. The circulation in the capillaries, especially of the face, neck and upper part of the chest, is so much increased as to redden the skin.[318]

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[317] Henry Jacob Bigelow, "Nitrous Oxide Gas for Surgical Purposes in 1848.," *Boston Medical & Surgical Journal* 72 (1868): 114-115.

This flushing of the face and increased heartbeat were understood as signs of asphyxiation. Wells' opponents proposed that it was not some property of nitrous oxide that caused these physiological changes, but a simple lack of essential oxygen.[319] Both Morton and Jackson subscribed to the belief that nitrous oxide had no specific or unique chemical bearing on the human system. Morton, and his supporters in New England, claimed that because nitrous oxide did not do anything to the human body, Wells had no claim to the discovery of surgical anesthesia. Jackson reported that he and Morton had done "legitimate" experiments and announced to the medical community that nitrous oxide had no more effect than exhaled air.[320] Jackson published his conclusion that nitrous oxide possessed no anesthetic properties in his *Manual of Etherization.*[321] Colton, in defending the efficacy of nitrous oxide and the sinister characters of Morton and Jackson, recalled how the pair had characterized the gas after the introduction of Letheon.

> Dr. Morton claimed that Nitrous Oxide was *not an anaesthetic*, and that insensibility to pain could not be produced by it ... Dr.

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[318] John Collins Warren, *Etherization: With Surgical Remarks* (Boston: William D. Ticknor & Company, 1848), 10.

[319] The idea that the effects of nitrous oxide are due only to asphyxiation dates from Davy's early experiments in Bristol. Cf. "Review of 'Notice of Some Observations Made at the Pneumatic Medical Institution' by Thomas Beddoes.," *The Anti-Jacobin Review and Magazine* 6 (1800): 424-428, Samuel Latham Mitchill, "On the Part Which the Imagination Acted in the Experiments at the Bristol Pneumatic Institution, with Nitrous Oxyd.," *Medical Repository* 5 (1802): 461-462.

[320] This exhaled air was known as Carbonic Air, air exhaled by humans and animals during the act of respiration which is lacking in the oxygen needed to survive.

[321] Truman Smith and P. W. Ellsworth, *An Inquiry into the Origin of Modern Anaesthesia* (Hartford, CT: Brown and Gross, 1867), 66.

> Jackson endorsed this view, stating that in his work on Chemistry, that he had tried the gas with 'large orifices and small orifices' and could not produce insensibility with it.[322]

Morton stated that it was suffocation by carbonic air that made patients inhaling nitrous oxide delirious. They claimed that nitrous oxide in and of itself had no intoxicating or exhilarating properties. In this case, patients experience exhilaration due to a lack of oxygen in their bodies.[323] Thus the pair concluded Wells' demonstration was a failure because the substance used, nitrous oxide, simply did not induce anesthesia.

The problem with this interpretation of Wells' failure is that it does not take into account much of the evidence of the exhilarating and intoxicating effects of nitrous oxide, both in medical applications and in the context of the popular public nitrous oxide exhibitions. In addition, after Wells failure in Boston, nitrous oxide was used intermittently by a number of surgeons and dentists in surgery, admitting of its anesthetic abilities. Contrary to Morton and Jackson, nitrous oxide was tried as an anesthetic, with some success. Wells gave the gas for a few major surgeries after his Boston fiasco. The beginning of 1848 brought two significant successes.

> Dr. Wells gave the nitrous oxide gas on January 1, 1848, to Henry A. Goodale, and Dr. P. W. Ellsworth amputated his leg. Also, January 4, gave the gas to Mrs. Gabriel and Dr. S. B. Beresford removed a fatty tumor from her right shoulder.[324]

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[322] Gardner Quincy Colton, *Anaesthesia. Who Made and Developed This Great Discovery? A Statement Delivered Upon the Mellowing of Occasion* (New York: A. G. Sherwood & Co., 1886), 5. Emphasis in original.

[323] Gardner Quincy Colton, *A True History of the Discovery of Anaesthesia : A Reply to Elizabeth Whitman Morton* (New York: A.G. Sherwood, 1896), 8. Emphasis in original.

[324] James McManus, *Notes on the History of Anaesthesia : The Wells Memorial Celebration at Hartford, 1894: Early Record of Dentists in Connecticut* (Hartford: Clark & Smith, 1896), 16.

It is notable that these surgeries took place in Hartford, not Boston. They generated little notice from the Boston medical community. Years later in the 1860s Bigelow, Morton's key proponent and now a surgeon on staff at Massachusetts General Hospital, published an article which recalled a case of nitrous oxide being used in surgery in Boston in 1848.[325] On April 27, 1848, Bigelow himself removed a carcinoma of the breast using nitrous oxide as anesthesia, although he concluded from the experience that the gas held too much risk of asphyxia for long surgeries.

> She remained quiet, however, and in a short time was evidently insensible, though the muscles were not perfectly relaxed ... the patient made no outcry or other sign of suffering until sometime during the ligation of the arteries, when she expressed a little uneasiness. She recovered perfect consciousness soon after, without unpleasant symptoms.[326]

Bigelow in this case was disappointed by the lack of relaxation of the muscles, a common side effect with ether inhalation. He determined that this lack of muscle relaxation was enough of a reason to dismiss nitrous oxide as an anesthetic, despite the fact that the patient did not feel pain during the procedure. Bigelow apparently also subscribed to the view that asphyxia was an issue with nitrous oxide, attributing once again any insensitivity to pain consequent to inhalation as a side effect of suffocation, but dismissed the possibility of wide spread use of the gas on the grounds that it was inconvenient to produce.

> Anaesthesia by nitrous oxide was then abandoned, not only in view of the livid surface and muscular rigidity, both doubtless due of asphyxia, but also on account of the inconvenience of the

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[325] Henry Jacob Bigelow, "Nitrous Oxide Gas for Surgical Purposes in 1848.," *Boston Medical & Surgical Journal* 72 (1868): 6-10.

[326] John C. Dalton case report, reprinted in Henry Jacob Bigelow, "Nitrous Oxide Gas for Surgical Purposes in 1848.," *Boston Medical & Surgical Journal* 72 (1868): 7-8.

> preparation of the gas on a large scale, and especially from the bulk of the apparatus required for its administration.[327]

Nitrous oxide may have been inconvenient for surgeons to produce in the late 1840s, but as a counterpoint it is worthy to note that Colton had no problem producing large amounts of the gas while traveling and presenting his nitrous oxide exhibitions during this period. This inconvenience may have been an exaggeration on Bigelow's part, an excuse rather than a reason not to use nitrous oxide.

Years later, after the efficacy of nitrous oxide as an anesthetic was beyond dispute, Bigelow characterized Wells' failure as the result of improper administration technique. He associated Wells' technique with the "exhilarating" technique that Colton used for his nitrous oxide exhibitions.

> Wells want of success can now be satisfactorily explained. He had, through Colton, in following Davy's instructions, made use of the traditional exhilarating gas bag, and of Davy's exhilarating dose. This volume of gas is inadequate to produce anaesthesia with any certainty ; and Wells failed to suggest a larger dose. This omission closed his chances.[328]

Bigelow is correct that the exhilarating dose of 2-3 gallons is not enough to produce anesthesia; 8 gallons of gas are the minimum needed. It is not however clear that Wells was utilizing Colton's exhilarating dose. At the initial experiment at his office in December of 1844, Wells told Colton to push the administration beyond anything he had tried before, which Colton did. Wells lost consciousness, and Riggs extracted the molar. So Wells did seem to understand that larger

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[327] Henry Jacob Bigelow, "Nitrous Oxide Gas for Surgical Purposes in 1848.," *Boston Medical & Surgical Journal* 72 (1868): 6.

[328] Henry Jacob Bigelow, *Surgical Anaesthesia: Addresses and Other Papers* (Boston: Little, Brown and Company, 1900), 142.

doses were needed for surgical operations when he experimented with administering the gas to his patients throughout December of 1844 and January of 1845. Contrary to what Bigelow claimed, at least in theory, Wells seemed to know that a large dose of gas was needed. Bigelow's insinuation that Wells' failed because he was associated with Colton and the exhilarating uses of nitrous oxide seems to be a case of professional prejudice.

Accounts by historians

We have seen some of the reasons why Wells' Nineteenth-Century contemporaries believed that his demonstration failed. None of these explanations is entirely satisfying, being open to counterargument. Now we will examine some of the explanations for Wells' failure offered by professional historians. By far the most common explanation given by historians of science and medicine for Wells' failure is that although nitrous oxide in principle can produce an anesthetic state, Wells made some error in the administration of the gas at his Boston demonstration. Barbara Duncum offered the possibility that Wells produced an inadequate state of insensibility, rather than complete anesthesia.

> It is probably, however, that he never achieved a complete insensibility but was satisfied with analgesia, a state in which the patient is semi-conscious yet oblivious to pain.[329]

Duncum's theory is that anesthesia itself was impossible to achieve using the gas-bag methodology that Wells employed for his Boston demonstration. Kenneth Bryn Thomas agrees,

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[329] Barbara M. Duncum, *The Development of Inhalation Anaesthesia; with Special Reference to the Years 1846-1900* (London: Oxford University Press, 1947), 98.

specifically placing the emphasis on the technology of the time and further claiming that even analgesia was unlikely. The equipment itself takes the blame for Wells failure.

> The wooden mouthpiece and stopcock are attached to a bag of oiled silk of about 2 litre capacity. In use, air was excluded as far as possible (a nose clip was often provided) and it is apparent that the size of this bag barely provided enough gas for adequate analgesia. If such a size was in fact used by Wells, the it is likely that herein lay the primary cause of his failure.[330]

The problem with these types of explanations is that they do not take into account that categories such as "anesthesia" and "analgesia" did not exist at the time of Wells' demonstration. These categories had to be negotiated, and what needs to be explained is how they were established and who was involved in their solidification. It was not that Wells failed to produce anesthesia, but that he was unable to convince witnesses that such a state was possible, and that nitrous oxide was the way to achieve this state. Wells was trying to convince his observers that nitrous oxide did something that they simply did not believe was a medical possibility. Duncum and Thomas are looking at past events and analyzing them using categories that had not yet been established. Both of the aforementioned historical accounts isolate the events surrounding the production of knowledge about anesthesia from the greater social context of the United States in the middle of the Nineteenth-Century. Despite several earlier successes with the gas, Wells failed on the occasion of his Boston demonstration. These initial successes, defined by Wells as pain free surgical experiences, also lend weight to he idea that it was not intrinsically impossible

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[330] Kenneth Bryn Thomas, ed., *The Development of Anaesthetic Apparatus: A History Based on the Charles King Collection of the Association of Anaesthetists of Great Britain and Ireland* (Oxford: Blackwell Scientific, 1975), 117-118.

to produce a pain free operation using nitrous oxide and the technology at the time Wells gave his demonstration.

Other historians have claimed that the reason Wells' demonstration failed was that ether was the better anesthetic. Richard Wolfe states that nitrous oxide is simply not as effective as ether, which explains why Wells was unable to convince his audience of the potency of the gas.

> While it is impossible to deny Wells his original discovery, a careful study of the evidence leads to the conclusion that his loss of favor early in the anesthesia story is attributable to the fact hat he backed the wrong drug.[331]

William Stanley Sykes makes similar arguments. He implies that nitrous oxide is less predicable in its effects than ether, which explains why Wells was unable to successfully demonstrate it in Boston.

> Nitrous oxide is the weakest of all anaesthetics and by far the most difficult to control, partly of its gaseous state and partly because of its lack of power.[332]

Both Wolfe and Sykes make a mistake here by comparing nitrous oxide to ether. At the time of Wells' demonstration, ether was not thought of as a substance which could quell surgical pain. There were no anesthetics, and as such there were no criteria by which to judge the efficacy of nitrous oxide or ether. It was up to Wells to negotiate a success. Nitrous oxide did not fail because ether was better; the criteria for anesthesia had not yet been established. Ether was not

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[331] Richard J. Wolfe, "Who Was the Discoverer of Surgical Anesthesia? A Brief for Horace Wells.," in *I Awaken to Glory: Essays Celebrating Horace Wells*, ed. Richard J. & Menczer Wolfe, Leonard F. (Boston: Boston Medical Library, 1994), 26.

[332] William Stanley Sykes and Richard H. Ellis, eds., *Essays on the First Hundred Years of Anaesthesia*, III vols., vol. I (Edinburgh: E. R. S. Livingstone, Ltd., 1960), 120.

used as an anesthetic until nearly two years after Wells' demonstration. A comparison between the efficacy of the two substances can only be done in retrospect, and more importantly, once criteria for establishing successful anesthesia had been established. Wells observers had nothing to compare nitrous oxide to besides the fun and intoxication they themselves had experiences with the gas; there had as of yet not been any pain-free surgeries. The fact that two years after Well's failure Morton was able to negotiate a successful pain-free surgery using a different substance surely cannot be retrospectively assigned as a cause for Wells' failure.

A Novel Analysis

As we have seen, previous historical explanations for Wells failure and Morton's success have been incomplete at best and absurd at worst. In this section, I propose novel explanations for Wells' failure and Morton's success which take into account the unique history of nitrous oxide presented in the previous chapters. First I will call into question the typical characterization of these two events as demonstrations. Instead, I believe that they functioned more as public experiments. Since experiments and demonstrations serve different purposes in the production of knowledge, categorizing them as experiments helps to emphasize the role that the observers played in negotiating success and failure. Second, I will examine three key ways in which Wells' nitrous oxide demonstration differed from Morton's Letheon demonstration, three difference that have gone unnoticed by historians: location, technology and terminology. While these three differences served to undermine Wells' demonstration, they functioned positively at Morton's.

Both Wells and Morton's events before an audience have been considered by historians to be scientific demonstrations.[333] Demonstrations are understood historically as being different from, and in contrast with, experiments. Steven Shapin and David Gooding represent two broad ways of conceptualizing the differences between experiment and demonstration. Shapin argues that during the seventeenth century, experiments developed into knowledge generating activities done by specific people, honorable and trustworthy men, in specific isolated locations.[334] The moral character and social status of the experimenter was important because experimenters had to generate the new phenomena from which scientific knowledge was born, and had to be trusted not to present mere illusion or speculation as new knowledge. In a fashion similar to Shapin, Gooding treats experiments as events done in isolation. In contrast with experiments, Gooding argued that demonstrations are public displays of natural facts, complete and non-negotiable.[335] Demonstrations are finalized events, brought before lay audiences in order to both educate observers and display the power of scientific practitioners.

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[333] Cf. W. H. Archer, "Dr. Horace Wells, Dentist, Who First Discovered, Demonstrated and Proclaimed the Blessings of Surgical Anesthesia," *N Y J Dent* 39, no. 10 (1969): 458-460, Richard B. Gunderman, "Dr. Horace Wells and the Conquest of Surgical Pain: A Promethean Tale," *Perspectives in Biology and Medicine* 35 (1992): 531-548, Howard Riley Raper, *Man against Pain; the Epic of Anesthesia* (New York: Prentice-Hall, 1945), W. D. A. Smith, *Under the Influence: A History of Nitrous Oxide and Oxygen Anaesthesia* (London: Macmillan Publishers, 1982), 57.

[334] Steven Shapin, "The House of Experiment in 17th-Century England," *Isis* 79, no. 298 (1988): 395-399.

[335] David Gooding, "In Nature's School: Faraday as an Experimentalist," in *Faraday Rediscovered: Essay on the Life and Work of Michael Faraday 1791-1876*, ed. David Gooding and F. A. James (London: Macmillan, 1985), 108. For a similar view on demonstration, see Simon Schaffer, "Machine Philosophy: Demonstration Devices in Georgian Mechanics," *Osiris* 9 (1994): 157-158.

We thus have a dichotomy between experiments as open-ended private processes, and demonstrations as non-negotiable public events. Wells public use of nitrous oxide and Morton's public use of ether are historical cases that seem to be neither demonstrations nor experiments. They were like demonstrations in that they were presented before an audience, but they were like experiments in Shapin's sense, in that they were knowledge generating activities needing the approval of their audiences. Far from being finalized and non-negotiable, these events needed the consensus of gentlemanly witnesses to be characterized as successful. Additionally, the human subject was reinterpreted as part of the experiment, taming the capricious aspect of human testimony. It was not so much a case of chemicals acting *on* people, as chemicals acting *with* people, resulting in the new phenomena of painless surgery. Rather than subscribing to the view that experimentation is done cloistered in the laboratory, while demonstration is the public presentation of scientific knowledge achieved under these isolated conditions, I argue that these public events displaying nitrous oxide and ether functioned as a type of experimentation. Knowledge was generated and negotiated through these events. They serve as examples which emphasize the localized nature of the emergence of scientific knowledge, and point to the key role that the audiences of these events played in their negotiation.

By examining the two crucial public experiments of painless surgery from the mid-1840s, we can compare the failure of the nitrous oxide event with the success of the ether event to ascertain just what change occurred in the scientific perception of these chemicals.[336] We shall see

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[336] There is ample literature that suggests that ether and nitrous oxide are both effective for painless surgery. I will not debate the efficacy of the chemicals; such a debate is not necessary to support the conclusions of this paper. Cf. Norman A. Bergman, *The Genesis of Surgical Anesthesia* (Park Ridge,

how the unpredictability of the interaction of these chemicals with human subjects was transformed by objectifying the human subject under the clinical gaze, and by dismissing the testimony of the subject in favor of the consensus of an objective and distinct observer-audience. I shall then show how the success of ether was specifically constructed by reinterpreting the demonstration of Letheon as a successful public experiment using an unknown substance that was specifically invented for the purpose of pain-free surgery.

The first notable difference between the nitrous oxide and ether events is how the observers treated the subjective experiences of the individual inhaling the chemical. In the case of nitrous oxide, the there was little evidence that the inhaler felt pain during the procedure. Daniel T. Curtis, a witness to the event stated:

> I am not able to say whether the patient experienced pain or not. There was certainly no manifestation of it, yet some present expressed themselves in the belief that it was an imposition.[337]

Those who did believe that the patient experienced some pain were in the majority, despite the fact that the patient himself did not know when the tooth was removed.[338] The consensus of those

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IL: Wood Library-Museum of Anesthesiology, 1998), 321-345, Leonard F. Menczer and Richard J. Wolfe, eds., *I Awaken to Glory: Essays Celebrating the Sesquicentennial of the Discovery of Anesthesia by Horace Wells, December 11, 1844-December 11, 1994* (Boston, MA: Boston Medical Library in the Francis A. Countway Library of Medicine Boston in association with the Historical Museum of Medicine and Dentistry Hartford, 1994), W. D. A. Smith, *Under the Influence: A History of Nitrous Oxide and Oxygen Anaesthesia* (London: Macmillan Publishers, 1982), 109-122, Richard J. Wolfe, *Tarnished Idol: William Thomas Green Morton and the Introduction of Surgical Anesthesia : A Chronicle of the Ether Controversy* (San Anselmo, CA: Norman Publications, 2001).

[337] Horace Wells, *A History of the Discovery of the Application of Nitrous Oxide Gas, Ether, and Other Vapors, to Surgical Operations* (Hartford: J. Gaylord Wells, 1847), 13.

present was that the demonstration had been a failure. What we see here is that the testimony of those witnessing the event, professionals and students, was deemed of greater reliability than the testimony of the human subject. Whereas with the early nitrous oxide inhalations of the Bristol circle the testimony of those partaking of the gas was understood to be essential, in this context subjective notions of sensation were dismissed in favor the consensus of the group. The medical men, as a group, decided what the patient had felt. For the ether event, a similar process is described. Witness Henry Jacob Bigelow wrote:

> During the operation, the patient muttered, as if in a semi-conscious state, and afterwards stated that the pain was considerable, though mitigated; in his own words, as though the skin had been scratched with a hoe. There was probably, in this instance, some defect in the process of inhalation...[339]

Bigelow's comment implies that immediately after the event, the principle of painless surgery was taken to be sound, even if the practice was in this case faulty. With the ether event, the patient expressed signs of distress during the procedure but those witnessing the event still deemed it to be a success. In spite of the testimony of the subject, the consensus of the physicians and surgeons was of more importance.[340]

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[338] Gardner Quincy Colton, *Anaesthesia. Who Made and Developed This Great Discovery? A Statement Delivered Upon the Mellowing of Occasion* (New York: A. G. Sherwood & Co., 1886), 4, Gardner Quincy Colton, *A True History of the Discovery of Anaesthesia : A Reply to Elizabeth Whitman Morton* (New York: A.G. Sherwood, 1896), 5.

[339] Henry Jacob Bigelow, "Insensibility During Surgical Operations Produced by Inhalation," *Boston Medical & Surgical Journal* 35 (1846): 309.

[340] For the definitive work on the transformation from person to object in medicine, see Michel Foucault, *The Birth of the Clinic: An Archaeology of Medical Perception.*, trans. A. M. Sheridan Smith (New York: Tavistock Publications, Ltd., 1973).

The presence or absence of Warren, the most famous surgeon in Boston medical society during the 1840s, at both of these events served to mediate their importance.[341] In the case of nitrous oxide, Wells, an unknown dental surgeon, performed the tooth extraction for students from Warren's medical class *after Warren had left* them to inhale nitrous oxide for pleasure. However for the ether event, *Warren himself performed* the surgery while Morton administered the ether. Warren's participation added an aspect of professionalism to the ether event not found at Wells' demonstration, thus bringing in an element of gentlemanly expertise. In the case of nitrous oxide, Warren opined his suspicions on the outcome of the event when he introduced Wells by stating,

> There is a gentleman here who pretends he has got something which will destroy pain in a surgical operation. He wants to address you. If any of you would like to remain and hear him, you can do so.[342]

As a figure of gentlemanly authority, Warren helped to shape the perceptions of these events by offering his own implicit approval or disapproval in front of his students, who then followed his social cues and dismissed nitrous oxide but approved of ether for painless surgery, especially when Warren stated at the end of the first ether surgery that it was *not* a humbug.

Both Wells and Morton's demonstrations functioned socially as experiments. Although both had performed trials with their respective substances, at the time they presented their

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[341] Warren's fame is attested to in contemporary accounts of the demonstrations. Cf. Henry Jacob Bigelow, "Insensibility During Surgical Operations Produced by Inhalation," *Boston Medical & Surgical Journal* 35 (1846): 309-317, Nathan P. Rice, *Trials of a Public Benefactor : As Illustrated in the Discovery of Etherization* (New York: Pudney & Russell, 1858).

[342] Gardner Quincy Colton, *A True History of the Discovery of Anaesthesia : A Reply to Elizabeth Whitman Morton* (New York: A.G. Sherwood, 1896), 5.

finding in Boston, the results were open to negotiation. Morton was even less confident of his potential for success, using an apparatus he had never even seen before the morning of his Hospital experiment. Their audiences were active participants in determining the result of their demonstrations. Sociologist Harry Collins observed, "Experimenters can never be sure that their results, or others' results, are correct; therefore they need something in addition to experiments to settle scientific controversies."[343] Experiments are negotiations, and these experiments with nitrous oxide and ether at Massachusetts General Hospital functioned as loci for the construction of knowledge about anesthesia. In the case of the 1845 nitrous oxide demonstration, the efficacy of the gas in this context was disputed not because of empirical error or faulty testimony by witnesses, but because there was no agreed upon criteria for defining a successfully anesthetized patient. The failure of Wells' demonstration in conjunction with the myriad explanations offered by parties involved for that failure highlight the fact that this experiment was very much an unsettled, negotiated event.

Redefining nitrous oxide and ether

At the time of these demonstrations, there was a significant amount of knowledge originating both within and without learned medical circles about nitrous oxide and ether. As we saw detailed in chapter 3, nitrous oxide was a popular form of entertainment not only in small private gatherings, but at large public entertainments. Itinerant showmen presented the gas as part of an entertainment spectacle. Interested parties would climb up on the stage to sample the

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[343] H. M. Collins, "A Strong Confirmation of the Experimenter's Regress," *Studies in History and Philosophy of Science* 25, no. 3 (1994): 502.

gas which made takers run around recklessly and prance with glee. Ether had a similar reputation, and "ether frolics" were small parties where the drug was inhaled for amusement. Even academic lectures on the gases at medical schools were traditionally followed by sampling parties, where students could inhale both laughing gas and ether for amusement. Bigelow recalls that in 1847 ether was well known as an intoxicant.

> There is scarcely a school or community in our country where the boys and girls have not inhaled ether to produce gayety.[344]

Ether had a similar reputation to nitrous oxide, but tended to be used by smaller groups of people. Charles T. Jackson remembered how ether was popularly used in the 1820s and 1830s.

> College boys and factory girls had inhaled Ether with the utmost freedom, without any ill effects upon their health.[345]

Ether was used more often in private groups for pragmatic reasons: ether was a vapor, easy to handle and store and cheap to purchase. In his textbook on chemistry, Thomas D. Mitchell, who taught medicine at the College of Ohio after studying in Pennsylvania, recalled how ether was popularly used in small groups for amusement.

> Some years ago, a practice obtained among the lads of Philadelphia, of inhaling the vapor of sulphuric ether, by way of sport. A small quantity, placed in a bladder, was almost instantly converted into vapor, by the application of hot water.[346]

Nitrous oxide was relatively expensive when compared with ether, contributing to ether's popularity with small groups. Ether gained a certain degree of notoriety through word of mouth,

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[344] Henry Jacob Bigelow, *Surgical Anaesthesia: Addresses and Other Papers* (Boston: Little, Brown and Company, 1900).

[345] Charles T. Jackson, *Manual of Etherization* (Boston: Mansfield, 1861), 16.

[346] Thomas D. Mitchell, *Elements of Chemical Philosophy* (Cincinnati: Corey & Fairbank, 1832), 172.

and was a common parlor entertainment. In 1839 William E. Clarke, who was a chemistry student in Rochester, New York, commonly entertained his friends with sessions of ether inhalation. He continued the practice while he was a student at Berkshire Medical College in 1841 and 1842.[347]

Both nitrous oxide and ether were substances of notoriety during the first half of the Nineteenth-Century. However knowledge of both substances was relegated to the realm of entertainment and frivolity. They were used in public and private contexts as catalysts of amusement. Nitrous oxide and ether were deeply entrenched in the larger culture of antebellum American entertainment. Historian William S. Sykes in a rare moment of insightfulness emphasized the novelty of applying nitrous oxide and ether within a surgical context:

> These were not ordinary demonstrations of non-negotiable facts but something revolutionary, something incredible, something utterly unheard of, performed before an audience of unbelievers, to whom the thought of painless surgery was merely a bad joke or the dream of a madman.[348]

Painless surgery would only become a possibility if these popular substances could be redefined so as to be acceptable in a medical context.

Wells was unable to negotiate the legitimacy of nitrous oxide in a surgical context. Morton, however, succeeded in redefining ether so it was acceptable within medical circles. By pointing out three different ways that Morton's public experiment differed from that of Wells, I

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[347] H. M. Lyman, *Artificial Anaesthesia and Anaesthetics* (New York: William Wood and Co., 1881), 6. See also: J. D. Mansfield, "The Inhalation of Ethereal Vapor, Etc.," *Boston Medical & Surgical Journal* 35 (1846): 424-425.

[348] William Stanley Sykes and Richard H. Ellis, eds., *Essays on the First Hundred Years of Anaesthesia*, III vols., vol. I (Edinburgh: E. R. S. Livingstone, Ltd., 1960), 121.

shall explain Morton's success with ether. The first difference is location, the second is technology used for administering the chemicals, and the third is the terminology used to refer to the chemicals. These three differences are the key to understanding these experiments and explaining why ether was a success and nitrous oxide a failure.

Although both of these events took place at Massachusetts General Hospital before an audience of medical students, their specific locations within the hospital differed dramatically. Wells experiment was moved to the side both physically and temporally, scheduled later in the evening in an anonymous classroom where the students were preparing to inhale nitrous oxide for their own amusement. According to medical student Cincinnatus A. Taft, it was after Warren introduced Wells that they moved for the first time to a new location.

> The students accordingly retired to an adjoining room, where we were addressed upon the subject by Mr. Horace Wells... who invited us to meet in the evening to witness an operation, which operation was performed in our presence, while the patient was under the influence of the gas.[349]

The group had moved again to meet later in the evening, in yet another unremarkable classroom. Notice the similarity between the context of this event and the nitrous oxide demonstrations that students were accustomed to participating in at the conclusion of their chemistry lectures. Wells took the class to an adjoining room at the end of Warren's lecture, effectively physically and psychologically separating his own discussion from Warren's instruction. After explaining why he believed nitrous oxide could be used for painless surgery, Wells invited the students back at a later time to witness the operation. Wells explained this delay:

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[349] Horace Wells, *A History of the Discovery of the Application of Nitrous Oxide Gas, Ether, and Other Vapors, to Surgical Operations* (Hartford: J. Gaylord Wells, 1847), 15.

> I remained several days in Boston in order to have an opportunity of administering the gas to a man who was expecting to have a limb amputated, but the operation was postponed. I was then invited to extract a tooth for a patient in the presence of the medical class...[350]

As Wells distanced himself in both time and place from the authority of Warren and the operating theater, his credibility diminished. Assisting Warren with an amputation would have been an honor and source of social currency for Wells, increasing his gentlemanly credibility. Pulling a tooth in front of a group of medical students was practically a form of amusement.[351] This context was too easily associated with the nitrous oxide demonstrations that the students were accustomed to attending in conjunction with their chemical lectures.

Morton, in contrast, arrived immediately before Warren was about to remove a facial tumor from a patient in the operating theater. Morton rendered the patient insensible with his compound and Warren performed the operation for an enthralled audience of medical students. By situating his event in the context of the surgical theater, Morton effectively removed any associations the students might have made with post-lecture inhalation antics related to ether, even if they had been able to identify the substance he had employed.

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[350] Horace Wells, *A History of the Discovery of the Application of Nitrous Oxide Gas, Ether, and Other Vapors, to Surgical Operations* (Hartford: J. Gaylord Wells, 1847), 4.

[351] There is a long tradition of tooth-pulling as entertainment. Cf. Ricky Jay, "Dental Deception," in *Jay's Journal of Anomalies: Conjurers, Cheats, Hustlers, Hoaxsters, Pranksters, Jokesters, Impostors, Pretenders, Side-Show Showmen, Armless Calligraphers, Mechanical Marvels, Popular Entertainments* (New York: Farrar Straus and Giroux, 2001), 127-134, Roger King, "Curing Toothache on the Stage? The Importance of Reading Pictures in Context.," *History of Science* 33 (1995): 396-416, Malvin E. Ring, *Dentistry : An Illustrated History* (New York; St. Louis: Abrams ; C.V. Mosby, 1985), 105-187.

The second difference between the two events lies in the technology used to administer the chemicals. Wells used the standard equipment used to administration of nitrous oxide for amusement: the silk bag fitted with a stop-cock. These silk bags were used by the large scale public demonstrators like Colton, as well as professors and students in chemical classes, to store and administer the gas to individuals. The students were well familiar with this object as a visual cue to intoxication. Morton avoided any prior associations with ether when administering his gas: he had a new apparatus constructed specifically for his demonstration at the hospital. Ether was generally applied for intoxication by soaking a rag with the substance and then inhaling from it. When Morton arrived at the operating theater, he not only had a novel apparatus that had never before been seen by those observing the procedure (hardly the ether soaked rag that students would have understood as a visual cue to ether use and intoxication), but one which he had never himself tested. In contrast with Wells, who used existing technology along with all of the social connotations that technology bore, Morton displayed new, untested technology for the purpose of his ether event. This allowed for his audience to avoid making any associations with the frivolous applications of ether, leaving completely open for interpretation the function and usage of the novel apparatus.

The third difference between the two events lies in terminology. Whereas Wells was transparent about the identity of his substance by telling all involved that he was using nitrous oxide, Morton was secretive. He instead claimed that his substance was a new compound, one called Letheon, created specifically to produce painless surgery. Morton did not reveal to either Warren or his students that this "new" compound was nothing more than sulfuric ether disguised

by dyes and perfumes.[352] This allowed him the luxury of presenting an substance which was completely free of the social and cultural baggage that accompanied common ether. When Wells openly and honestly explained that he was using nitrous oxide for painless surgery, he inadvertently imported all the trivial and frivolous connotations that accompanied nitrous oxide exhibitions during the first half of the Nineteenth-Century. When Morton showed Letheon, he presented a novel substance with no wider social associations, one whose definition could be constructed and negotiated by those present in the surgical arena.

In the case of Wells' 1845 nitrous oxide experiment, the gas was already entrenched in a wider context of meanings associated with entertainment and popular culture. Morton was successful in 1846 because he controlled three important elements of the experiment: location, technology and terminology. Morton unveiled his substance and the technology for administrating it in the surgical dome, in front of professional surgeons and students alike. He managed to avoid associations with amusement and frivolity by presenting his discovery as a completely new object, without the epistemic baggage that ether carried tying the popular entertainment and social freakery, knowledge about Letheon was negotiated *ex nihilo* specifically as medical knowledge. Consequently, Boston surgeons adopted it as a dedicated medical technology for use in surgical operations.

Colton's success in the 1860s at reviving nitrous oxide use in dentistry can be explained in exactly the same terms as Wells' failure and Morton's success. Colton shifted location, technology and terminology surrounding nitrous oxide anesthesia as well. He created the

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[352] Richard H. Dana, "A History of the Ether Discovery. Report of the Massachusetts General Hospital," *Littell's Living Age*, no. 201 (1848): 543-553.

Colton Dental Association locations as specific sites for the use of nitrous oxide as an anesthetic. Working with Sprague, he updated his equipment for administering the gas, and incorporated new ideas and innovations. Lastly, Colton separated nitrous oxide from laughing gas, allowing both their own existence, but in separate arenas. Nitrous oxide was used in dentistry and medicine to quell surgical pain, while laughing gas served a number of larger social functions in the context of entertainment.

By breaking the associations between ether, nitrous oxide and whimsicality, Morton's demonstrations at the surgical dome in1846 and Colton's separation of nitrous oxide and laughing gas in the 1860s served to reveal the possibility of an entirely novel use for these chemicals: painless surgery. The introduction of chemical substances for painless surgery shows how location, technology and terminology all function to close experimental controversies. In the case of inhalation anesthesia in America, traditional explanations which resort to claims about knowledge generated only within a medical context are insufficient to explain why surgeons believed that nitrous oxide did not cause insensibility in medical contexts, but did in frivolous and entertainment situations. In contrast, we have examined much of the knowledge produced about nitrous oxide and ether during the Nineteenth-Century, and found that a great deal of it was generated in the context of middle class entertainment. This knowledge cannot be discounted when constructing a narrative of the history of anesthesia. The larger cultural context in which these substances were used had a profound effect on how they were understood within medical spheres.

Chapter 7. General Conclusions

From its first isolations in the late Eighteenth-Century, nitrous oxide was an elusive and mysterious substance. Priestley found its contradictory properties perplexing and Mitchill was afraid of its potential to destroy human life. Davy's formal and informal experiments with the gas in Bristol emphasized the unique and subjective experiences of those who inhaled it. His dismissal of the gas in favor of the voltaic pile once he had moved to the Royal Institution shows how Davy's priorities had changed. After 1801, he was concerned with his ability to present himself as master of the scientific, and favored the voltaic pile and its reliable results as a subject for his public lectures rather than the untamable and unpredictable nitrous oxide gas.

Although Davy had dismissed the gas for its unpredictability, this very aspect of nitrous oxide brought about its popularity in America during the first half of the Nineteenth-Century. Lecturers gave talks and demonstrations of the gas, highlighting the strange and unpredictable behavior of those who inhaled it, rather than their subjective sensations as Davy had catalogued at Bristol. As exhibitions of the gas gained popularity, its cultural importance increased. During a period when it was difficult to distinguish the honest man from the confidence man, nitrous oxide was used to reveal the inner concealed character. By the mid-1840s, nitrous oxide was a show business headliner, with individuals flocking to see the true nature of their neighbors revealed in public.

Colton's position as a liminal figure, one who danced with both science and entertainment and contributed to the production of knowledge in both arenas, allowed him the

insight to revive nitrous oxide as an anesthetic in the 1860s. With the establishment of the Colton Dental Association, Colton constructed a new context in which nitrous oxide was put to use as an anesthetic. As a student of the world of Barnum, Colton maintained the position of the gas as a factor in constructing cultural identity by continuing his laughing gas exhibitions, encouraging those who inhaled the gas to reveal themselves publicly as psychological freaks.

The reason that Wells' 1845 demonstration was considered a failure was that he used a substance that was already known in the context of entertainment and attempted to transfer it wholesale into a medical context. Wells assumed that his audience at the Massachusetts General Hospital would be amenable to the idea that nitrous oxide could be used in surgery. However, he was unable to convince his audience of the efficacy of the gas, and nitrous oxide remained entrenched in the world of amusements.

Morton's ether demonstration of 1846 was successful because Morton controlled the location, technology and terminology surrounding his substance. His control of these aspects of his ether demonstration served to neutralize any connotations of frivolity, including intoxication and social impropriety. Letheon, as a socially and technologically neutral substance, was embraced by medical practitioners as a new technology created specifically for use in the surgical sphere. Through examining resources from popular media and culture, it became obvious that nitrous oxide had far greater significance in Nineteenth-Century culture than was previously understood by historians of medicine. By contextualizing this substance, we now can understand why Horace Wells' 1845 experiment in Boston with the gas failed, as well as why nitrous oxide was not used prolifically as an anesthetic until the 1860s.

At the conclusion of this project, it is helpful to reflect in more concrete terms on what I have insisted has been an interdisciplinary approach to the historical substance nitrous oxide. In outlining how different techniques were integrated into the project from various sub-disciplines in the humanities, I hope to suggest to other scholars by way of example inroads leading to fresh and fertile areas of research open for intellectual cultivation.

My first conscious technique in approaching this project was to vigilantly seek out historical data from primary sources that are not typically used by historians in the history of science and medicine. Clearly, the sources that I have mined that are more typically used in cultural history fall into this category. Newspapers and more importantly, popular magazines are rarely integrated into research in the history of science, medicine and technology. It is often assumed that such sources only reflect the results of knowledge production, and are not necessarily partially responsible for producing information that contributes the development of knowledge. Oftentimes scientific or technical objects are understood by contemporary historians as being somehow displaced from the wider cultural milieu. In the case of nitrous oxide, as we saw outlined in the literature review in Chapter 1, historians of medicine and chemistry have not been vigilant about garnering information generated outside of what they believe to be the community that produced the knowledge, namely, scientists and/or physicians. This project has demonstrated that it is indeed possible to find ideas that dramatically affect the production of knowledge outside of these sequestered communities of so-called professionals. Conversely, cultural historians have also sometimes been overwhelmed by the overall trends across larger groups, such as the middle class, and in the process have missed how small tight-knit sub-groups, such as surgeons, use their social power and prestige to change larger ideas that deeply affect the

masses. Karen Halttunen's article about the pornography of pain in Nineteenth-Century culture does just this, and in the process she misunderstands how pain developed as a professional problem for surgeons.[353] I have taken steps in remedying this overall issue of over-specialization by integrating primary sources typically assessed only by cultural historians or historians of science. In this case, using the substance nitrous oxide as the physical historical locus of research, I have found that the gas itself leads one off in unforeseen yet entirely profitable directions.

Another way in which I have consciously pursued interdisciplinarity in this project has been to integrate theoretical constructs and analysis tools from sister humanities. From philosophy, I have kept mindful of current trends in ontology throughout my research. This mindfulness manifested itself in examining the possibility of how objects, much like individual people, are historically situated and constructed. This simple distinction, although I chose not to make it explicit at any point in the thesis narrative, was key in my approach and analysis of the development of nitrous oxide anesthesia. I chose this path in contrast with making the realist assumption that nitrous oxide itself was a static and given object which human agents simply fluttered around and reacted to, and this allowed me to examine nitrous oxide in an entirely novel way.

Additionally, I have integrated tools from the sociology of science, specifically Harry Collins' idea of the Experimenter's Regress.[354] The concept that experiments themselves are sites of negotiation and are far from simple demonstrations was essential in understanding the

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[353] Karen Halttunen, "Humanitarianism and the Pornography of Pain in Anglo-American Culture," *American Historical Review* 100, no. 2 (1995).

[354] Cf. H. M. Collins, *Changing Order: Replication and Induction in Scientific Practice* (Chicago: University of Chicago Press, 1992), 11.

anesthesia demonstrations at Massachusetts General in the 1840s. The disparate character of testimony presented by witnesses to these demonstrations serves as evidence of the contested and far from given conclusions of these events. In questioning the assumption of conclusive results, I have shown that sociology is pertinent to historical analysis, demonstrating that suspending foregone conclusions and examining particular historical situations as sites of negotiation can unearth unforeseen debates and power struggles essential in understanding the development of a particular idea or technology.

Historians can oftentimes become seduced by the tangible: bits of paper, books and notes from significant archival collections and various public records all remain enticing to the meticulous scholar. However, throughout the course of this project I have been fortunate in that addition to caressing century-old papers, I have stumbled upon a wealth of digitized resources that have not been addressed by scholars researching the history of nitrous oxide anesthesia. Digital image and document collections, such as the Edgar Fahs Collection and the Smithsonian Institution Libraries Digital Library, have been useful in finding key visual and hard-to access textual clues to the way that nitrous oxide was understood and addressed during the Nineteenth Century. Similarly, digitized databases such as that of the Proquest Historical Newspapers and American Periodicals Series Online, which allow for keyword searches, open up entirely new avenues of efficient and through research. As more of these types of databases become available to historians through the digitization of newspapers and other ephemera, it becomes possible to gather ever larger sets of data on the use of nitrous oxide in the United States during the Nineteenth-Century. I appealed to these types databases as supplements in accumulating primary source material for this project, and I foresee that adding these types of database

searches to the physical archival research key to any historical endeavor will only be an asset to future scholars.

As this thesis has suggested, nitrous oxide itself can be approached or understood in myriad ways: as a natural chemical assembled from substances found in nature; as the invention of a specific group of experimental chemists in Britain just prior to the turn of the Nineteenth Century; as a type of inhalation anesthetic; as a tool for the construction and reinforcement of middle class values; as a catalyst of frivolous entertainment; as a key ingredient in the establishment of one of the first medical franchises in America; as pathway towards unearthing heretofore unknown subjective experiences; or even, as Martin Pernick has shown, a contributory tool in establishing medical authority and professional boundaries. It is my sincere hope that this project might itself be understood as a new starting point for historians of anesthesia and chemistry, as well as an asset to those attempting to understand the greater development of Nineteenth-Century American culture.

Appendix I: New York Times advertisements 1863-1873

YEAR	EXHIBITION ADS	CDA ADS	TOTAL ADS
1863	24	79	103
1864	8	105	113
1865	2	182	184
1866	3	129	131
1867	0	60	60
1868	0	49	49
1869	3	45	48
1870	2	27	29
1871	0	66	66
1872	10	58	68
1873	20	36	56

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