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A Fig For Your Philosophy and Great Knowledge in the Sciences: Observation, Deception, Scientific Fraud and Social Authority in the Antebellum Museum

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Abstract: There is an increasingly sophisticated literature on the role played by museums in reaffirming social norms of examination in the antebellum United States. This literature has largely focused on the way museums presented this knowledge to the public, not how audiences reacted to claims of scientific authority. Popular reaction to pseudoscientific claims demonstrated to the public in the scientific context of museums, in this case Charles Redheffer's 1812 perpetual motion device and P. T. Barnum's Fejee Mermaid, shed light on the close relationship between early popular scientific observation and ways of judging authenticity and deception in the commercial and social realms of the antebellum period.

Have you travelled thro' the pages of the Natural Historian*? come and satisfy your mind, that he has not deceived you. Come and look nature in the face, and you will be more highly delighted and satisfied than by historic description. Have you, at any time, read of beings whose existence you doubted? call at this repository. Your doubts will vanish, and before you depart your mind may receive impressions emanently conductive to morality and virtue. Those who have no leisure to read, may, at a trifling expence, furnish themselves with a considerable portion of knowledge--a species of knowledge that may be found necessary in almost every condition and department of life. Even a slender knowledge of*

nature removes a certain littleness of mind, protects us from impositions which affected greatness too often attempts on ignorance and credulity, and calls forth emotions of gratitude to the great Parent of ALL.[1]

When William Waldron placed this advertisement for his American Museum in the New York *American Citizen and General Advertiser* in the spring of 1801, few who read the advertisement could likely imagine that some day the museum would be one of the dominant cultural attractions of its age. It was not the oldest museum in the cities of the eastern seaboard, nor did it have the broadest collection. These honors belonged to the most prominent American museum of the day, Charles Willson Peale's Philadelphia Museum. And indeed, the early history of the American Museum brought it little fortune. Following a change of hands in 1832, the heirs of Waldron's taxidermist, John Scudder, would sell the museum to Connecticut native Phineas Barnum for $12,000 in 1841. Under P. T. Barnum, the museum boomed, becoming the most popular attraction in the city, and one of the most-visited sites in the republic.

In the Barnum era, the American Museum was often criticized for being unscientific and morally deleterious to its city and the nation. But Barnum still claimed to serve the same function that William Waldron enumerated in his first advertisements: not only educating the public about the wider world of nature, but also demonstrating how to investigate the claims of others to scientific, economic, and moral authority. While some of what Barnum exhibited was pseudoscientific in nature or of dubious relation to reality, the museum did not encourage its patrons to

[1] Advertisement for Waldron's American Museum from the New York *American Citizen and General Advertiser*, April 1, 1801.

take claims to the nature of the exhibits at face value. Rather, like in William Waldron's advertisement, members of the audience were to vanquish their doubts through their own observations. Visitors to Barnum's American Museum were expected to use the same techniques of scientific observation as Waldron and his contemporaries had used for the natural world at the start of the century—but by the middle of the 19th century, these techniques had matured into a major element of cultural, commercial, and social life.

Although there is a paucity of sources on how the public performed scientific observation at these museums, pseudoscientific claims exhibited at both Barnum's American Museum and the Peales' Philadelphia Museum crystallize the tensions between observer and scientific authority. Pseudoscientific exhibitions both made scientific claims and were part of the culture of deception historians have argued was most feared in the antebellum city.[2] Because the claims are presented as untrustworthy to observers, they are encouraged to use scientific techniques of observation to discern the truth or falsity of scientific claims. Questionable scientific claims exhibited in public also produced much more public clamor and concern over the styles of looking than regular new exhibits: both Redheffer's Perpetual Motion and Barnum's Feejee Mermaid were heavily covered in popular newspapers and scientific reports intended for popular consumption, reflecting and attempting to alter the way non-specialists thought about scientific knowledge and social authority.

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[2] See particularly Karen Halttunen, *Confidence Men and Painted Women: A Study of Middle-class Culture in America, 1830-1870* (1971. New Haven: Yale UP, 1982), 33-55.

The American Museum began to be historicized as soon as it met its demise. On the afternoon of July 13, 1865, the American Museum was destroyed in a fire that began in the cellar of a restaurant beneath Barnum's offices and rapidly spread through the museum.[3] Two weeks later Edward Lawrence Godkin, an editor of the New York *Evening Post*, wrote an essay in *The Nation* which decried the late museum's collections as "without a catalogue, without attendants, without even labels… the heterogeneous heap of 'curiosities,' valuable and worthless mixed together," a poor comparison to its earlier existence or the stately and well-organized museums of London.[4] Instead of scientific education, it offered only "the most gross deceptions… to cause a week's wonder and to swell the week's receipts."

Eventually, this depiction crept backwards in time: not only was Barnum's museum a sideshow interested only in deceiving its own customers, but earlier museums—excluding private cabinets of curiosities and museums operated by scientific societies—were painted with the same brush. When depicting the history of American museums in an influential 1888 address before the American Historical Association, Assistant Secretary of the Smithsonian G. Brown Goode criticized American museums of the first half of the nineteenth century, echoing Godkin's accusation and implying that the collections of museums were put together without "reference to their value to investigators, or their possibilities for public

[3] "Disastrous Fire," New York *Times* (July 14, 1865).
[4] Edwin Lawrence Godkin (unsigned), "A Word About Museums," *The Nation* I.4 (July 27, 1865), 113. Edwin Godkin is identified as the author of the piece in *Museum Origins: Readings in Early Museum History & Philosophy*, Hugh H. Genoways and Mary Anne Andrei, eds. (Walnut Creek, CA: Left Coast Press, 2008), 33.

enlightenment."[5] Early museums, he argued, were important only insofar as they provided an antecedent to be replaced by the great American museums of the late nineteenth century.

This Whiggish position dominated understanding of American museum culture well into the 1970s, although John Rickard Betts began to stake out a dissenting understanding in 1959. His article "P. T. Barnum and the Popularization of Natural History" placed the American Museum within the context of other museums' scientific displays, rather than dismissing it outright. In 1973, Neil Harris' biography of P. T. Barnum situated his career among Jacksonian tensions that beset the "much-celebrated common man" and popular entertainments that played on these tensions[6] This is only one element of the larger picture of the role museums and scientific knowledge played in the early nineteenth century, however. Roughly contemporaneously, museum historians began to reexamine the museums that preceded Barnum's American. The most thorough of these studies are Charles Coleman Sellers' on the Peale family museums, although Sellers often subscribes to a Godkin-esque sensibility regarding the Peales' role as the true forerunners of the modern American museum, drawing a sharp contrast with Barnum. Joel Orosz's model of the development of scientific museums, periodized to show how museums were "direct products of the American democratic culture" developing "in synchronization with the evolution of the wider cultural climate," offered an

[5] G. Brown Goode, *Museum-History and Museums of History* (New York: Knickerbocker Press, 1889), 263. Reprinted from the papers of the American Historical Association.
[6] Neil Harris, *Humbug* (Chicago: University of Chicago Press, 1981), 3.

excellent alternative to the histories that ignored the early American museums and it has been widely adopted.[7]

All of these approaches, however, only tell us about the curators' relationship to the public, not how the public viewed the curators or uses the museums. While Neil Harris has some suggestions, Orosz and Sellers are mainly interested in the culture within museums. To reach a method for understanding public reactions to museums and their contents, there are several traditions that must be combined. The first is suggested by the notion of the temple and the forum, which Duncan F. Cameron introduced in a prominent 1971 article in the museum studies journal *Curator*. As temples, museums sacralize knowledge and experience; as forums, museums allow "confrontation, experimentation, and debate" within their audience.[8] The most useful attempt to put this framework into the context of the early nineteenth century museums is Les Harrison's *The Temple and the Forum*, which puts name to strains already seem in Harris, Sellers, and Orosz. The other useful way of approaching audience response to museums is through broader cultural histories of entertainment, social life, and deception. Of these, James W. Cook's 2001 *The Arts of Deception* most specifically deals with Barnum and fears of dissimilarity. It builds on the portrayal of Barnum as a sort of sanitized confidence man in Karen Halttunen's *Confidence Men and Painted Women*, which examines larger strains of social and commercial deception in popular culture.[9]

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[7] Joel J. Orosz, *Curators and Culture: The Museum Movement in America, 1740-1870* (Tuscaloosa: University of Alabama Press, 1990), 3.
[8] Cameron quoted in Les Harrison, *The Temple and the Forum* (Tuscaloosa: University of Alabama Press, 2007), xiii.
[9] For Barnum specifically see Halttunen, 30.

The final element in explaining how museum audiences related to exhibits and exhibitors is looking at scientific culture in the period—especially the observational sciences of the colonial era and the first decades of the republic. There is a broad consensus on the individual-participatory nature of scientific research in the colonial period; investigation into natural phenomena was a practice of individuals using their talents to discern the truth directly from plants, animals, minerals, and occurrences like lightning and oceanic currents. This individual observation was typified as particularly American in both the colonial and early national periods, contrasted with European or metropolitan analysis of relayed observations.[10] There also existed simultaneously a practice of exchanging scientific information and especially specimens in a gift economy to establish one's social place in the world of research.[11]

The American Museum and the Philadelphia Museum both existed through what are currently considered to be three different periods, with three distinct ethos and relationships to their audience. First was what Orosz calls the "Moderate Enlightenment," where the museum modeled behavior for its patrons. Then came the "Didactic Enlightenment" style of popular science: clear-cut, with a predetermined educational plan to instruct the audience in how to think about scientific knowledge.[12] Afterward, it was dominated by the style of "the Age of Egalitarianism." Education became exploitative, and the openness of every exhibit to

[10] See especially Susan Scott Parrish, 128-135.
[11] *Ibid*., 189-200.
[12] Orosz, 68.

audience questioning and reinterpretation carried the reformer spirit of democratic participation in the rational society "past the point of absurdity."[13]

Historians have characterized this period as one where scientific knowledge was presented in an egalitarian way, with all potential audiences being able to interact with it and thus perform science. This is typically presented as a new feature that emerged in the 1820s, but in fact these types of scientific knowledge date back further than Barnum's acquisition of his New York museum or the educational reformers of the 1820s. They were part of an observational style of science that dated back to the colonial era, a type of knowledge that many museums before Barnum had attempted to popularize. Popular observational science made up the core of Barnum's American Museum's appeal—an appeal that made it easily the most popular attraction in the country. This was the same sort of popular observational science that both museums and humbuggers embraced: conceptually accessible and closely linked to emerging patterns of thought about social reliability and commercial savvy. The education promoted by the American Museum under Barnum was both scientific and social, but undercurrents of it existed in periods the that have been seen as strongly didactic by historians, lacking any significant questioning or pushback from audiences.

In the first month of 1813, newspapers up and down the eastern seaboard reported on the failure of a peculiar device that had risen to some fame in Philadelphia. Charles Redheffer,[14] a millwright in Philadelphia County, had come to local fame claiming to have invented a machine that would rotate in perpetuity, and

[13] *Ibid* 133.
[14] Sometimes Readheffer, Reidheffer, or Redhefer.

exhibited it for interested parties to see—after paying a fee. As reward for inventing this tremendous new device in the Commonwealth of Pennsylvania, Redheffer appealed to the government in Harrisburg for some protection or remuneration. Instead, the committee assembled by the legislature denounced Redheffer publicly as a sham. But this was done not though equational proofs or appeals to Newtonian laws. In the public eye, the thing that caused Redheffer's undoing as an inventor and scientist was his attempts to control the public's observation of the Perpetual Motion.[15]

Redheffer's device was a spindle that appeared to be driven by the falling motion of four weights. As two weights fell, they would draw up the weights they were connected to, until they fell in turn; the whole motion pushed the disc on which the weights and angles were mounted around a central shaft.[16] The entire device was enclosed in a case—embellished with rounded knobs at the top—for easy viewing by the public. Redheffer's device was intended to be displayed as openly as possible, with its component parts available for examination while operating—albeit from a distance. In actuality, a spring-wound device inside the main disc caused it to rotate slightly as long as it remained wound by a series of linkages leading to a knob on the frame.[17]

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[15] Redheffer referred to his machine as "the Perpetual Motion," but period sources also refer to it generically, and Rubens Peale refers to the device created by Isaiah Lukens in imitation a "perpetual motion." I have tried to follow convention by referring to Redheffer's with capitalization, and the class of machines generally as perpetual motions or by generic terms.

[16] *An Accurate Delineation of Readheffers Perpetual Motion*. W. Y. Birch, Philadelphia, Pennsylvania. At least four different perpetual motion devices were created by Charles Redheffer over his career. The machine depicted in this broadside matches the one attributed to Redheffer currently in the collection of the Franklin Institute in Philadelphia.

[17] Rubens Peale, *The Memorandum's of Rubens Peale*, 15.

That the controversy surrounding Redheffer's device would be focused on observation rather than practical theory seems strange, but it fits well within the popular understandings and practices of science at the start of the nineteenth century. Popular understandings of science, both in the museum and in well-known research, focused on descriptive accounts of phenomena. From electricity to ocean routes, historical inquiry into this period has focused on the relationship between the observer, who notes phenomena, and the expert, who analyzes them.

Half a century earlier, fellow Philadelphian Benjamin Franklin portrayed himself as a simple observer of phenomena when he announced his understanding of the Gulf Current in the Atlantic Ocean. His chart, which won him recognition in London scientific circles, was prepared from popular knowledge of routes accumulated by observation by sailors. Franklin would come to nationalize this sort of observational knowledge in the period after the revolution, contrasting British science with the observational truths of "simple American fishermen."[18] Franklin's feat with oceanic currents is recapitulated in scientific inquiries into lightning in the late eighteenth century. The attempts of Philadelphians David Rittenhouse and John Jones to examine the mechanics of lightning and the effectivity of lightning rods—major contributions to understanding of physical phenomena that were also widely present in the popular imagination—focused on their ability to observe and describe its path through a house.[19]

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[18] "A letter from Dr. Benjamin Franklin … containing sundry maritime observations," American Philosophical Society *Transactions* 2 (1786), 314-15. Quoted in Joyce Chaplin, "Knowing the Ocean: Benjamin Franklin and the Circulation of Atlantic Knowledge," *Science and Empire in the Atlantic World*, Eds. James Delbourgo and Nicolas Dew (New York: Routledge, 2008): 89.

[19] James Delburgo, *A Most Amazing Scene of Wonders: Electricity and Enlightenment in Early America* (Cambridge, Mass: Harvard UP, 2006): 77-80.

These cases broadly typify the way Americans at the turn of the nineteenth century understood themselves as scientists and participants in scientific research: the key to scientific understanding was through observation, without necessarily requiring a specialized knowledge set. Where expertise was useful was in the "artisanal dexterity," to use James Delbourgo's phrase, used in deciphering events and putting together experimental devices.[20] In opposition to this artisanal skill in the world of colonial science and natural history was the metropolitan theorist, the interpreter of meaning at a distance from the physical phenomena considered. American electrical scientists—in particular, Franklin again—drew distinctions between their inherently accurate observations and the theoretical systems of European science, with their ability to be divorced from the practical workings of the physical world.[21]

Of course, this mode of scientific thinking did not evaporate with the American Revolution and the reshaping of fringe-metropole relationships in the first decades of the United States' existence. To a certain degree, they found themselves being remapped: in Charles Willson Peale's Philadelphia Museum—later taken over by his sons—observational science was the primary means of research. The first successful public scientific museum in the United States, it drew on a respectable audience for its 25-cent admissions fees to keep it running.[22] But it also drew most

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[20] *Ibid*. 34.
[21] *Ibid*. 39-40. On observations of biological diversity and natural history in the colonial period, see also Susan Scott Parrish, *American Curiosity: Cultures of Natural History in the Colonial British Atlantic World* (Chapel Hill: University of North Carolina Press, 2006): 103-108.
[22] For information on donors see David Brigham, *Public Culture in the Early Republic: Peale's Museum and Its Audience* (Washington: Smithsonian Institution Press, 1995), 114-121.

of its exhibits from the same group, becoming the locus for dissemination and analysis of others' observations.

While Charles Willson Peale would often go hunting with his sons for specimens—in particular birds of the Delaware river valley and the eastern shore of the Chesapeake—he also relied on donors to keep the museum supplied with the latest scientific observations of the natural world, be it, as an advertisement noted in early 1792, "from Africa; from India; from China, from the islands of the great Pacific Ocean, and from different parts of America." But observations of American nature still led the way, with the "novelty of its vast territories" as "but a small number is yet known of the amazing variety of animal, vegetable, and mineral productions, in our forests of 1000 miles, our inland seas, our many rivers, that roll through different states, and mingle with the ocean."[23] Observation was something Americans were uniquely poised to take advantage of, and the Philadelphia Museum encouraged it through its collections as well as its style of exhibition.

The displays of the Philadelphia Museum also reflect the observational style of popular science in the early republican period. While Charles Willson Peale's self-portrait *The Artist in His Museum* is the most famous depiction of the Peale Museum, it is the earlier watercolor *The Long Room* that offers the best understanding of the attempt at scientific ordering of the natural world undertaken for benefit of the museum's audience. According to David Brigham, it represents nature as an "essentially rational order" where animals and plants are arranged by their

[23] Philadelphia *General Advertiser*, January 20, 1792.

Linnaean physical and geographical resemblances to one another.[24] The appeal of this descriptivist approach—indeed, the notion behind the whole system of classification—is that any interested comer will be able to understand it.

It was into this culture of easily observed popular science that Charles Redheffer presented his Perpetual Motion device. By presenting it in a case, apparently open for all elements to be examined by the observer, he tapped into broader understandings of how scientific discoveries are supposed to make themselves known to the public: through the ability of others to see, in this case, how the pieces fit together. This was the key to defenses of Redheffer's machine: by mechanical principles, the machine was to be considered "a ingenious deception," as the Raleigh, North Carolina *Star* announced on December 25, 1812. The counterargument to this dismissal was that the machine had been "examined with the most scrutiny in the presence of 20 or 30 persons" and examined in pieces without the discovery of an "impelling power."[25] While the machine is known not to be able to work, it still has been observed to work, and so by some undiscovered principle must.

What Charles Redheffer perhaps did not count on was the presence of expertise in his audiences or their willingness to attempt to reproduce the machine for themselves. In Philadelphia, a clockmaker named Isaiah Lukens, having seen the Perpetual Motion, duplicated Redheffer's design and was able to control whether the device would be propelled by its clockwork mechanism or the fall of the

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[24] David Brigham, *Public Culture in the Early Republic* (Washington, DC: Smithsonian Institution Press, 1995): 45.
[25] "Duane still persists…" (Raleigh, North Carolina *Star*, December 25, 1812).

weighted carriages. Rubens Peale, who had by that point taken over the family's Philadelphia Museum, notes that Lukens, "being a good mechanic and of a philosophical mind at once decided the folly of this discovery," had constructed his own version of the device to test how he believed the machine should, in philosophical principle, work.[26] He then exhibited the device to his friends, noting "this model was correctly made and well calculated to show Mr. RedHeffers principles to be unphilosophic."[27]

When Rubens Peale attempted to operate machine by its purported principles, Lukens "observed that perhaps [he] had not put in sufficient weight, and then touched the spring." Unable to explain how the device operated, but seeing that it did, Rubens informed the room that he was unconvinced of its truth. The crowd that had assembled in Isaiah Lukens' workshop took a different approach to Rubens' perplexity. When, against the weight of theory, the device appeared to operate, Rubens recalls the group as having told him "a fig for all your Philosophy and great knowledge in the sciences."[28] The notion of scientific observation had, for Lukens' visitors, trumped the theoretical underpinnings of how it was explained to work. Not wanting to leave his friend out of the deception, however, Lukens ran after Rubens and explained the clockwork mechanism that actually powered the device.

Lukens' visitors were expressing a particular understanding of observational science, one that would come to its apogee in the self-confusing understandings of Barnum's American Museum. For them to assert that their observations were more

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[26] Peale, *Memorandum's* 13.
[27] *Ibid*. 14.
[28] *Ibid*.

valid than the theoretical understandings of a fairly prominent scientist brought them into the same tensions Benjamin Franklin played between the observer and the elite theoretician. They were also, whether in jest or in seriousness, creating their own interpretation of Lukens' work. It is not clear from the *Memorandum's* why Lukens intended to trick his audience, but as he later performs the same trick on Redheffer, it would seem to be a counter to the audience's reinterpretation: while they attempt to create their own meaning from their personal observations, Lukens knows the truth, and thus to himself—and then to Rubens—asserts his authority over theirs. Because the audience is unphilosophical in its approach to science, they do not have the power they believe themselves to have in this situation. The rejoinder, "a fig for all your Philosophy and great knowledge in the sciences," asserts the proper way for scientific knowledge to be gained is through observation, rather than theoretical knowledge. Lukens is asserting the same belief against them, and anticipates Orosz's professional displays of science.[29]

When Charles Redheffer appealed to the Pennsylvania legislature for recognition of his Perpetual Motion, a committee was appointed to examine the device to ensure its actuality. At this point, the expertise of its membership did come into play. Chaired by Henry Voight, one of the members was Nathan Sellers, who, along with his young son Coleman, raised observational questions about the fitness of the device. Unable to see it in operation due to a "conveniently missing" key, the committee was forced to observe through the window. It was here that Nathan Sellers' son observed that the machine had a problem: the cogs were worn

[29] For the professional scientific approach to exhibition of scientific knowledge, see Orosz, 140-145.

down on the wrong sides, indicating that the shaft appearing to be driven by the device was, in fact, propelling it.[30] This resembles Rubens Peale's story of how he determined Redheffer's device to be a scientific deception: he "placed a horse-hair over a cog and so kept the machine from starting, which perplexed him [Redheffer] very much and when I let go one end of the hair it commenced to move, this I several times repeated with the same result."[31] Minimal or no expertise was required for either set of observations; nor was any equipment necessary. Important instead was the observational and experimental approach, discerning details that differentiated hoax from true invention as they did one species of bird from another.

The committee members were not represented as experts, no matter how much expertise they had. What was more important was their ability to observe. When the committee was satisfied that Redheffer would not display the machine to them under their own terms, Henry Voight, as chairman of the committee, penned an explanation of the committee's findings for the Pennsylvania legislature as well as for general consumption. In this letter, which first appeared in the Philadelphia *Aurora* on February 3, 1813—but was widely reprinted afterwards—Voight accused Redheffer of refusing to demonstrate the machine's operation. It is this refusal, and not the "numerous vain attempts to construct self-moving machines on the ostensible principles of his," that cause them to declare Redheffer's device a fraud.

On the opposite side, Charles Redheffer's defense also relied on independent, non-expert observation. Like Rubens Peale's accusers in Lukens' shop, the

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[30] Henry Morton, "Engineering Fallacies" in *Cassier's Magazine Vol. 7* (1895): 203.
[31] Peale, *Memorandum's*, 15.

attestation of reliable citizens is more important than the theoretical explanations of how the machine might work. In the 1828 pamphlet *Documents For and Against Charles Redheffer*, a deeply sympathetic work, there is indeed no discussion of what the underpinnings of the operation of the Perpetual Motion might be. It contests that without Redheffer to put together the Perpetual Motion properly, the copies by Lukens and the committee must be inherently flawed: when they attempted to put together the device without his direction and were unable to make it operate, he "pointed out to them that the lever was out of its places, two or three inches, which they altered and on further examination the studs which support the lever was also found to be out of their places."[32] Rather than contesting the theory, Redheffer contests the correctness of the devices the committee observed. Beyond this, Redheffer relies on public testimony that the device did work: that, when correctly put together by its inventor, the Perpetual Motion "went much more truly and freely: and these deponents say, they continued in, or about the room the whole day, and that the machine continued running the whole time, without intermission and with perfect regularity."[33]

Redheffer's defense also lays out, with attestations before authorities, how Henry Voight first attempted to purchase the device from him and, upon refusal, tried to extort Redheffer by claiming to have invented an improvement to the device. Thus Voight had a motive to be a less than impartial witness to the operation

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[32] *Documents For and Against Charles Redheffer, as it Respects His Alleged Invention of Perpetual Motion. Collected from Authentic Sources* (Philadelphia, 1828): 20. Testimony is by Andrew Ardman, Andrew Bitting, Hiram Plows, and Henry Cress; the story is duplicated in slightly different detail by Erasmus Thomas on 21-2 of the same book.
[33] *Ibid*. 20-21.

of the device. Redheffer attests that his intention was not to use the Perpetual Motion in a plot to become wealthy—if he had, he would have accepted Voight's offer straight away. Furthermore, according to Redheffer, this is proof of the device's actuality: if he, the inventor, had not believed in the Perpetual Motion's ability to do what he said it did, he should "*being such a character*, have certainly pocketed the money."[34] The defense of Charles Redheffer's character is the primary aim of this pamphlet, but the defense has the secondary effect of defending the quality of the machine and the likeliness that it did, in fact, operate. As Redheffer clears his own name, he is also clearing the name of his invention.

This close relationship between personal standing and the standing of inventions seems to give forth an image of a class of amateur inventors and scientists, striving to be accepted into the upper strata of scientific Philadelphia society.[35] In June 1814, a Philadelphia mechanic named John George Baxter wrote to Rubens Peale at the Philadelphia Museum to offer his services in creating a spinning machine that could "spin twelve threads, reel seven single threads, double six, twiste six reel the six double & twisted and make six cotton thread balls."[36] The machine, if Rubens so wished, could also have "a small barrle organ" attached "to play or not as the spinner pleases." Ignoring the rather dubious entertainment or educational value of a combination spinning wheel-barrel organ, Baxter framed his letter in deference to Rubens Peale. His main aim is the public exhibition of his skill, although

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[34] *Ibid*. 12.

[35] For issues of social position and membership in elite scientific circles, see Simon Baatz, "Philadelphia Patronage: The Institutional Structure of Natural History in the New Republic, 1800-1833" *Journal of the Early Republic* 8.2 (Summer, 1988). For broadening of inventions, see Kenneth L. Sokoloff and B. Zorina Khan, "The Democratization of Invention During Early Industrialization: Evidence form the United States, 1790-1846" *Journal of Economic History* 50.4 (Jun. 1990), 369-372.

[36] John George Baxter to Rubens Peale, June 6, 1814.

he does wish some remuneration for his time—either a fraction of the device's proceeds or a sale at "not below five hundred dollars." Whichever Rubens preferred, however, Baxter wished to first exhibit the device so that Rubens could see it performed well and satisfactorily. Like Redheffer, his primary concern seems to be exposure; a quick payout, even in this case where the mechanic is desirous to make some profit, is less reliable than sustained public exposure over time, during which a relationship can be built between inventor and patron and observer and device.

Considering Baxter's desire to add to his spinning device, it is unclear if Redheffer intended for the case in which he placed the Perpetual Motion to be an embellishment, a marker of its museum-worthiness, or simply an excuse to build a frame to most easily hide a winding mechanism. In the accounts of both Rubens Peale and the Sellers family the method of display is taken special note of: Sellers noting that no one was permitted to observe the machine closely save through a barred window, and Peale noting the four columns and knobs concealing the operating mechanism.[37] By 1805 the Philadelphia Museum had developed a style of display that kept the audience at a remove from the collections: in the Long Room and other display rooms, small objects were kept in glass display cases.[38] Glass display cases were also viewed as ideal ways to display new inventions. In 1819, Patent Office superintendant William Thornton wrote to John Quincy Adams in praising the French patent model display system: models are made by experts, then

[37] For Sellers, *Perpetual Motion*, 126; for Peale, *Memorandum's*, 15.
[38] Charles Willson Peale, *Guide to the Philadelphia Museum* (Philadelphia: Museum Press, 1805), 4 and 6.

"placed on tables and covered with glass."[39] From Charles Willson Peale's *Guide to the Philadelphia Museum* it is unclear if the museum displayed its collection of patent models in glass cases, or only other objects in the Model Room, but certainly the potential was there by the time Redheffer constructed his machine: there were ways to separate an observing audience from an object.

The Philadelphia Museum also separated its visitors from some exhibits physically. In the watercolor *The Long Room*, a study for the more famous *The Artist in His Museum*, Charles Willson Peale depicts the main hall of the museum with rope barriers to prevent the audience from touching the exhibits. In *The Artist in His Museum*, these barriers are removed.[40] As the museum had had difficulty with visitors handling the exhibits, it seems reasonable to believe that the rope barriers were seen as a necessary but unfortunate way to keep visitors from more closely examining the collections.[41]

As William Leach indicates, commercial interactions between consumers and products under glass rarely occurred in the first half of the nineteenth century.[42] It is therefore difficult to gauge the relationship between commercial and display culture and programs of displaying artifacts and natural curiosities under glass at the museum: did audiences understand them in the same way they might goods in a

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[39] William Thornton to John Quincy Adams, Nov. 1, 1819, quoted in Daniel Preston, "The Administration and Reform of the U.S. Patent Office, 1790-1836" *Journal of the Early Republic* 5.3 (Autumn, 1985), 338.

[40] *The Artist in His Museum* also introduces a number of non-literal elements to its depiction of the Long Room, not least of which is the appearance of the famous mammoth in the place of glass display cases.

[41] At one point, the situation was such that "signs were put up conspicuously: 'DO NOT TOUCH THE BIRDS. THEY ARE COVERED WITH ARSNIC POISON.'" Nonetheless, museum visitors continued to handle them. Sellers, 28.

[42] William Leach, *Land of Desire* (New York: Pantheon, 1993), 55.

store, or as particularly museum-worthy objects? The case of the patent office models seems to indicate they were thought of in their own way, but this is an area in which more research needs to be done, both on commercial-consumer culture in the early 19th century and the relationship of audiences to secured-away exhibits in early museums that were open to the general public.

Regardless, Charles Redheffer's display of his Perpetual Motion crossed the line from proper styles of display into disingenuousness. The scientific delegation that visited him that day should have been expected to hold no exceptionally powerful abilities of observation over the average scientific observer. That his son Coleman had been able to spot the deception through the limited view did not alter the fact that Redheffer had attempted to prevent them from properly examining the machine. By taking the protection of the object—intentionally or simply through the honest misplacement of the key—to an unnecessary extreme, Charles Redheffer violated the relationship between the observer and the exhibitor by alienating the delegation from what they were supposed to see.

Despite the expertise wielded by the committee and the artisanal dexterity of Isaiah Lukens, the committee's exposure of Redheffer's deception was presented to the public as the inevitable consequences of observation. For William Duane, Redheffer's best-known defender, the inventor's unwillingness to demonstrate the machine to the satisfaction of the committee was what convinced him of the fraud, rather than the construction and display of Lukens' copy of the Perpetual Motion:

> The editor feels that it is due to himself and to the public to state, that he has for two successive days attended to the examination of the machine, in company with a considerable number of respectable millwrights, and others conversant in machinery, and examined every part of the machine, taken it to pieces, and put it

> together again, and without discovering any thing which could lead to a belief that here was any thing in it concealed. [Redheffer's] refusal to exhibit the machine, as he had promised, though it does not *prove* any deception in the machine, is nevertheless too mysterious and unreasonable to assure confidence, and unless explained in an open and unequivocal manner, must shake the judgment of those who felt the greatest gratification in the belief of its reality.[43]

William Duane neatly encapsulates both the understanding of observational science as something anyone should be able to do and the increasing importance of technical expertise in appraising the truth of scientific and technological claims. Where experts can be deceived—or at least convinced of a certain truth—Redheffer's refusal to demonstrate the operations of the Perpetual Motion to all demonstrates that the device is not to be believed as readily as the experts might think.

Duane's objection is in the language of scientific observation, but it also presages the concerns about deception that would emerge in the coming decades. While the urbanization Karen Halttunen identifies as a key tension in creating the fear of the confidence man was only in its most incipient state in 1813, Duane's concern that Redheffer was being deceptive is the key to his conclusion that the Perpetual Motion was false. But William Duane can still see a way forward, for individuals to cut through deception, one that authors of advice literature against confidence men would eventually argue was no protection: as Redheffer's conduct is "unreasonable," it stands that a citizen who uses his reason cannot be deceived permanently by his deceptive ways. A knowledge of reputation is important in using this skill—Duane specifically notes that the millwrights who examined the

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[43] William Duane, Philadelphia *Aurora*, January 25, 1813. Collected in Lillian B. Miller, ed., *The Selected Papers of Charles Willson Peale and His Family, Vol. 3* (New Haven: Yale UP, 1991) : 187-8.

Perpetual Motion were respectable—but there is also an inherent scientific ability of observation and reasoning that allows the individual to discern social deception.

A decade after Redheffer's debut as a manufacturer of perpetual motion, a young New Englander named Samuel Barrett Eades arrived in London. He brought with him a strange creature captured off the Japanese coast, carried with great pains from the Dutch East Indies around Africa, where he had briefly stopped in Cape Town to replenish his funds for the journey to England: a mermaid. This curiosity set off a stream of controversy and imitators that would last for decades. The ensuing mermaids and their histories reveal the close relationship between scientific understanding and commercial savvy: not just for their exhibitors, but also for the audiences who observed them.

Eades, the captain and eighth owner of the merchant ship *Pickering*, had purchased the mummified mermaid for 5,000 Spanish dollars—having unilaterally sold the ship and her cargo for 6,000 at Batavia to pay the price. Jan Bondeson, whose *The Feejee Mermaid and Other Essays in Natural and Unnatural History* gives the most complete narrative of the career of the nineteenth century mermaids, characterizes Captain Eades as naïve for selling the ship to purchase the mermaid.[44] Perhaps Eades overpaid, but the narrative of a massive initial outlay for a unique artifact was not unheard of. Although the owner took Eades to court to recoup the full value of the ship and its cargo, it certainly would not harm the mermaid's claims to one-of-a-kind status to have laid out such a massive sum. It is possible that this was simply an advertising effort gone awry.

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[44] Jan Bondeson, *The Feejee Mermaid and Other Essays in Natural and Unnatural History* (Ithaca: Cornell UP, 1999): 38-9.

In his 1855 autobiography, P. T. Barnum claims that as a young man in 1834 he responded to an advertisement of "IMMENSE SPECULATION on a small capital!--$10,000 easily made in one year!" The speculation in question was a "Hydro-oxygen Microscope," which Barnum could purchase from the claimed professor who had operated it for "only two thousand dollars," half in cash and the other within ninety days.[45] Barnum declined, but there were many microscopes in the circuit of scientific curiosities. Eades' creature was one-of-a-kind in the Atlantic world.

It seems, however, that despite its unique status, Eades' mermaid failed to make him any sort of fortune. Apparently ordered by a court to repay the rest of the *Pickering*'s owners, Eades exhibited the mermaid only from September 1822 to March 1823 before removing it from London for lack of crowds. In the first few months of its exhibition at the Turf Coffeehouse in London, however, it made a significant scientific stir. This scientific ambiguity did not seem to impact the success—or lack thereof—of the exhibit. However, like Redheffer, Eades' own defense came in two forms: his continued professed belief in the reality of his oddity, and his very inability to cash in. In American newspapers that reported on the story, Eades was personally quoted through a letter from the Rev. Dr. Philip of Cape Town as having refused 10,000 Spanish dollars for a fast sale of the mermaid.[46] Coming after a lengthy description of the mermaid's observable physical form that caused the Reverend Doctor to remark that he had "always treated the existence of

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[45] Phineas Taylor Barnum, *The Life of P. T. Barnum, Written By Himself* (Urbana: University of Illinois Press, 2000; reprint of New York: Redfield, 1855): 143-4. Bondeson notes a 5:1 exchange rate between the Spanish dollar and the British pound; the exchange rate between a United States dollar and the British pound over the 1822-1834 period is roughly identical. Lawrence H. Officer, "Dollar-Pound Exchange Rate From 1791," MeasuringWorth, 2011.

[46] "From a London Paper, a Mermaid," Morristown, NJ *Palladium of Liberty* (September 19, 1822).

this creature as fabulous; but my scepticism is now removed," this remark seems to follow Redheffer's assertion that a measurable way of determining the verity of novel scientific information is the desire of the individual making the statement to make money without further effort. For Eades and Redheffer, their audience's first questions of scientific truth would not be simply whether or not the thing was known to be physically or biologically possible, but whether the exhibitor was willing to openly and democratically display the object with his own belief behind it.

Eades further followed Redheffer's style by bringing the mermaid to the experts. Eades apparently initially attempted to get a recompense of some sort from the colonial government in Batavia for his discovery, but was rebuffed. Nonetheless, when he arrived in Cape Town, he knew who to show it to and how the creature should be described. Like Redheffer, he took the creature to a prominent local with at least some descriptive scientific interest, based on the detailed comparisons to other simians, and of high social standing or authenticity—in this case, a missionary leader. When he arrived in London, he again took it to scientific experts for verification, William Clift and Sir Everard Home. They declared it a fraud, but this was not Eades' interest: instead, he wanted to use their reputation to promote the mermaid. He advertised, "Sir Everard Home had declared the mermaid to be genuine," adding expert observational testimony to his commercial pitch. But while large crowds came to see the mermaid in London for a time, Eades was unable to turn this into a long-term success.

In Eades' hometown, mermaids were also popular, but were being exhibited in a different fashion. In July of 1824, the Columbian and City Museum in Boston

announced an exhibition of a "Sea Nymph, or Mermaid." But unlike the Eades mermaid, it was explicitly described as artificial: an "elegant specimen of workmanship in wax" and based on " a print published by the famous Gesner." But unlike the need to be extremely descriptive in questionable scientific claims, the technical curio did not require the aid of observational-descriptional science: it is, by the Museum's advertisement, a "non-descript Fabulous thing."[47] The artificial mermaid was advertised as a curiosity, but a curiosity of skill rather than scientific knowledge or experience. It did not require the testimony of personal observation to verify its claims.

The artful object approach was taken by the Philadelphia Museum when it acquired its own mermaid. Unlike the New England mermaids, the Philadelphia Museum object was intended to, like the Eades mermaid, look like a creature that had once been alive, preserved for public display. Like his ultimate approach to exhibiting the Perpetual Motion in the Philadelphia Museum, Rubens labeled his mermaid as a technical curio from the distant and exotic culture of Japan.[48] Its potential multiple understandings were collapsed in favor of the one backed by observational knowledge—one that the museum's audience could not personally participate in, due to the difficulty in handling the mermaid or exhibiting it as a fraud without destroying it in the process. But, of course, the Peale mermaid was not the most famous of the American museum mermaids.

The most famous of all the mermaid displays was P. T. Barnum's Feejee Mermaid. Or, rather, it was Eades', as Barnum recounts in *The Life of P. T. Barnum,*

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[47] *Columbian Centinel American Federalist*, July 10, 1824.
[48] Sellers, 299, 301.

Written by Himself: when Eades died in Boston, having not realized his expectations of wealth in London, his son sold the mermaid to Moses Kimball of the Boston Museum, who in turn brought it to Barnum. At this point, Barnum claims, he brought the mermaid to the museum's naturalist, who told him the creature must be manufactured, for "I don't believe in mermaids." Barnum's reply was "That is no reason at all, and therefore I'll believe in the mermaid, and hire it."[49]

Embedded in Barnum's defense of the mermaid is the same privileging of observational knowledge over technical expertise as happened to Rubens Peale when examining the Lukens perpetual motion. Here, though, it is the proprietor who is hedging himself against expertise. Of course, it was in Barnum's best interest to portray himself as being taken in by the excitement of the mermaid, and the scene has a light touch. But it was on this privileging of observational science that Barnum's museum made its fortune, having trebled the American Museum's income over the first three years of his operation versus the last three as Scudder's.[50]

In advertising, the approach used by the American Museum for the mermaid was twofold. Both Barnum and Moses Kimball depicted the mermaid in popular newspapers and prints as thoroughly womanly and looking perfectly human: the traditional depictions of mermaids that have come down to us.[51] Barnum attempted to hang a banner bearing the traditional image of a mermaid outside the American Museum in the early days of the exhibition, but was overridden by his lawyer and

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[49] Barnum, 231.
[50] Barnum, 242. Receipts—not profits—went from $33,811 to $100,429.43.
[51] For example, the images from the *Sunday Mercury* and *Sunday Atlas* on Barnum, 236 and 237.

collaborator, Levi Lyman.[52] But other public images of the mermaid distributed by Barnum depict the creature in a living state that might more readily match the mummified corpse. A print was created by the American Museum to portray the mermaid as she might have looked in life: not like the mermaids Barnum had shopped to the newspapers, but a simian creature, more human than animal—and perhaps imitating a human by leaning against a rock-pile—but distinctly not human.[53]

The same tension between humanity and animal life is present in the pamphlet Barnum wrote for the Boston Museum upon its acquisition of the mermaid, *A Short History of Mermaids*. Barnum's argument for the existence of mer-people—and he intends both mermaids and mermen—is fast and humorous. Using that most Enlightened of scientific techniques, the analogy, he argues that "by inference alone, it is natural to suppose that there are sea men and sea women," just as sea lions, sea wolves, sea horses, and sea dogs correspond to lions, wolves, horses, and dogs.[54] Barnum also quickly answers the "argument of anatomical impossibility": if sea-sponges can breathe, then mer-people must also be able to breathe somehow. These analogical arguments have the same tone as the humorous sections in Barnum's autobiography, and it seems difficult to conceive that an audience was expected to read them without some ironic intent. Barnum also argues against the opposition that due to the lack of any prior examples of a mermaid, mer-people must not exist. Instead, "might mermen and women argue against the

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[52] Jan Bondeson, *The Feejee Mermaid and Other Essays* (Ithaca: Cornell UP, 1999), 53.
[53] Reprinted on *ibid*., 52.
[54] P. T. Barnum, "The Feejee Mermaid" in P. T. Barnum, *The Colossal P. T. Barnum Reader: Nothing Else Like It in the Universe*, James W. Cook, ed. (Urbana, University of Illinois Press, 2005): 109.

existence of the human race, because they have been visited by so few of its representatives"?[55]

The other section of the pamphlet is significantly less humorous—it is the testimony from "an eminent Professor of Natural History in the city of New-York" He—presumably Barnum, or perhaps Levi Lyman—notes that the mermaid "is far from being the beautiful and captivating creature represented by the many pictures found in old books which profess to treat of mermaids."[56] Rather, it looks like an orangutang or monkey, and, while inhuman, is judged as well-proportioned for what it is. Where this statement takes its twist is when Barnum's professor attempts to establish it as "a connecting link between the fish and the human species" in the style of didactic natural history museum education like that found in the Philadelphia Museum of the Peales, by this time his rivals.[57] The link between the human and the fish is a testimony to the skill of "the infinitely Wise and Omnipotent Creator of this and myriads of other worlds," a religious tone that Barnum had previously had success with in the running Joice Heth shows. But the ridiculousness of the professor should not be overlooked: Barnum is asserting the non-value of theoretical natural history in favor of popular observational understandings of nature and its connections.

Just as Lukens' audience resisted his philosophical knowledge of how the Perpetual Motion should be expected to work, Barnum is allowing his audience to resist professional knowledge in the case of the mermaid. Barnum further confuses

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[55] *Ibid*., 110.
[56] *Ibid*.
[57] The contents of the New York Peale Museum had recently been denied Barnum by a contractual trick, although he purchased it shortly thereafter.

the matter by asking his audience to resist in both understandings: from observational knowledge that it might be real, and cannot be dismissed on the grounds that such things simply cannot exist, and from observational knowledge that it might not be real, and that to place it in an overblown, didactic format is to make it equally untenable in the face of popular scientific knowledge.

By his own devising, P. T. Barnum was the epitome of the scientific humbugger and confidence man. In his autobiography, he emphasizes his nature as not deceptive, but calling into question for the public things which he has trouble discerning. He indicates that he formed his own position—that the mermaid "was a most remarkable specimen of ingenuity and untiring patience"—during the controversy.[58] Barnum used popular observational science, derived from the pre-Jacksonian tradition, to emphasize Jacksonian social egalitarianism. The style of public interaction with science is not so different in the different eras of scientific authority in the public eye.

If Barnum was, in some aspects, a confidence man, he was one whose efforts were self-aware, tapping into both the history of popular scientific authority and fears about deception. While they were not always dissemblers, Barnum, along with Samuel Eades, Charles Redheffer, Isaiah Lukens, and Rubens Peale—indeed, the entire popular museum movement—traded in themes of hidden truths that must be uncovered through the skill of the observer. Observational science, in a tradition that dated back to the colonial era, offered a way for individuals to recognize and resist the hypocrisies of those who would take advantage of them, be it at the

[58] Barnum, *Life*, 235. This remained in all three editions of Barnum's memoirs.

museum or, increasingly, in the street. While the museum world changed, the approaches of museum-goers and those who went to see public scientific spectacles did not.

Museum audiences remain the least-examined part of museum culture in the nineteenth century, yet they are the most important driving force. In an era before endowments and significant public funding for museums, they provided the income needed to keep the museums open and their proprietors paid. It should not be surprising, then, that when P. T. Barnum set out to revitalize the American Museum in 1842 the choice of scientific approach would reflect broader social tensions. With his history in the exhibition of Joice Heth, it can be seen that he understood the tensions between different sorts of scientific knowledge. What historians of the nineteenth century American museums have passed over thus far is how connected that tension was to the history of public science.

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