ESSAY

Myth, Rumor, and History

The Yankee Whittling Boy as Hero and Villain

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The study of folklore and of ancient texts identifies certain stories as legends and myths. Frequently these stories name an individual god or hero as the personification or originator of a particular human technological accomplishment. Thus in Greek mythology the god Hephaistos is a blacksmith, and Prometheus is the heroic Titan who stole fire from the gods and gave it to human beings so they could keep warm, repel predators, cook meat, and, eventually, smelt metals.

Ascribing gradual, complex human achievement to a single hero both simplified the story and added color and drama. In the retelling, mythical heroes tended to acquire new attributes and accomplishments, plausibly linked by rather detailed anecdotes. Myths presumably evoked feelings of awe and admiration for the gods and heroes, and they provided convenient answers for children, who were always asking questions. If the inquisitive prehistoric child wondered, "Where did corn come from?" her elders didn't launch into an explanation of seed selection over thousands of years. "Corn came from the corn god," was the short and sufficient answer—as well as the opportunity for a good story. By word of mouth, and later in written form, myths and legends were passed from generation to generation down to our own more self-conscious and skeptical era in the post-Enlightenment Western world, where they survive as objects of literary and anthropological study.

New myths continue to be created in modern times. They get passed from person to person, and they get studied.[1] Some myths begin as rumors.

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1. Robert W. Brockway, *Myth from the Ice Age to Mickey Mouse* (Albany, N.Y., 1993), provides a commonsense, eclectic, and readable (albeit discursive) account of myths and

Social psychologists studying rumors in World War II did experiments in a controlled situation, such as a classroom, in which they would show a somewhat ambiguous picture to a person and note the ways in which his verbal description was modified in repeated retelling by others who did not see the picture themselves. Some details would be elaborated, others would fall out, leaving gaps that different, more colorful details would fill in. In summary, the social psychologists listed simplification, exaggeration, fabrication, and retention of colorful detail as characteristics of rumors over time. The participants in these experiments had no obvious interests to defend or establish, so the study was not of what motivations distorted the original descriptions but simply of regularities in how they were distorted.[2] Rumor and myth seem to have similar regularities.

Science and history have emerged in modern times, both ostensibly distinguished from myth by relating ascertainable facts instead of stories for children. Identifiable authorship also evolved over some hundreds of years, so that readers of, say, Charles Darwin or Rudyard Kipling knew the difference between fact and fiction, between natural history and an amusing story about how elephants got their trunks.

Thus, writers who are historians, as distinct from novelists and poets, try nowadays to write history instead of legends, and to demonstrate that they are seeking facts by following the established canons of historical scholarship. Particularly since the nineteenth-century Germanic convention of annotation spread among scholars, historical sources are traceable backward in time, and the paper chase through previous authors' footnotes is a well-recognized necessity in historical research. Yet to make any step forward the historian has to stop somewhere in this backward search for authenticity, to take at some point a piece of information as "established" knowledge. That end of the backward paper chase is sometimes a point so far into the past that there is, simply, no footnote to a previous source and no obvious reason for doubt. Sometimes, however, that point is much nearer to the present, in the trusted, and of course cited, work of another historian. Through this trust of other historians, legend and myth creep back into the writing of history, especially in the genre of biography.

One reason biographical myths about heroic inventors of the nineteenth century persist in history books today is that they began outside the gradually adopted canons of writing history and in their earliest written form supply no telltale footnotes by which to check authenticity. For

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theories of myth. See also Thomas J. Sienkewicz, *Theories of Myth: An Annotated Bibliography* (Lanham, Md., 1997).

2. Gordon Allport and Leo Postman, *The Psychology of Rumor* (New York, 1947). See also Ralph L. Rosnow and Gary Alan Fine, *Rumor and Gossip: The Social Psychology of Hearsay* (New York, 1976), which reports findings from later experiments and actual rumors.

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instance, Henry Howe in the United States, and to lesser extent Samuel Smiles in England, wrote outside those canons in composing their memoirs of eminent English and American mechanical and civil engineers, which we are busy nowadays debunking.[3] For many factual details, however, there is no earlier source available, so Howe and Smiles continue to be accepted, at least provisionally, as history.

Another probable reason heroic inventor myths persist is that technological changes in the nineteenth century, which were profoundly important and perceived as such at the time, involved complicated, prolonged, and ambiguous social, economic, and political interactions by many persons. These interactions have been too difficult for general historians, as well as the general public, to summarize except in mythical form. It is easier to let a hero personify a whole series of events. When the inquisitive Victorian-era child asked, "Where did spinning machines come from?" the memorialists of the time answered, "From Hargreaves, Arkwright, and Crompton," and supplied their stories.

Victorian-era biographers of inventors were strong on moral evaluation and usually presented their protagonists as quite admirable in character. These heroes were honest, well behaved, and kindly; they overcame daunting obstacles in achieving their goals, and benefited society by their achievements. The moralism of these biographies and the attention they pay to the hero's childhood are two features by which we recognize their mythical status as good stories for children.

Like the Victorian child, inquisitive historians of technology ask "Where do inventions come from?" Unlike the Victorian child, however, we are no longer satisfied with twice-told tales of particular inventors. Instead, we want to sift fact from fiction and winnow myths about heroic inventors down to truth—to debunk them. Yet as myths those stories about heroic inventors offer more levels for analysis than the one of distinguishing fact from fiction. Like other artifacts, myths are culturally shaped and can therefore yield information about the different cultures (and subcultures) that produced them if we ask questions at the appropriate level. Myths tell us about belief systems of different societies, including our own, and beliefs have force in shaping actions that are the stuff of history. For instance, what do myths identify as social and economic conditions that foster or discourage technological change, including inventions, in different societies at different times? What institutions in our own society do the myths consider important for encouraging invention? What value, negative or positive, does a specific culture or subculture place on invention and inventors? These are not the only themes relevant to the history of technology that can be found in myths about invention.

3. Samuel Smiles, *Lives of the Great Engineers* (London, 1860); Henry Howe, *Memoirs of the Most Eminent American Mechanics* (New York, 1840). For debunking, see Denis Smith, ed., *Perceptions of Great Engineers: Fact and Fantasy* (Wiltshire, 1994).

At even deeper levels myths may be able to tell us truths about basic human experience, such as "how inventive minds work."[4] Such is the case, I suggest, with the myth of the Yankee Whittling Boy, which says that American inventions of the nineteenth century came from youthful practice with a pocketknife.[5] An obscure poem published in 1857 captures the essence of this myth:

The Yankee boy, before he's sent to school,
Well knows the mystery of that magic tool,
The pocket-knife. To that his wistful eye
Turns, when he hears his mother's lullaby;
His hoarded cents he gladly gives to get it,
Then leaves no stone unturned till he can whet it;
And in the education of the lad,
No little part that implement hath had;
His pocket-knife to the young whittler brings
A growing knowledge of material things.

Projectiles, music, and the sculptor's art,
His chestnut whistle and his shingle dart,
His elder pop-gun with its hickory rod,
Its sharp explosion and rebounding wad,
His corn-stalk fiddle, and the deeper tone
That murmurs from his pumpkin-leaf trombone
Conspire to teach the boy. To these succeed
His bow, his arrow of a feathered reed,
His windmill, raised the passing breeze to win,
His water-wheel that turns upon a pin;
Or if his father lives upon the shore,
You'll see his ship "beam-ends upon the floor,"
Full-rigged, with raking masts and timbers staunch,
And waiting near the wash-tub for a launch.

Thus, by his genius and his jack-knife driven,
Ere long he'll solve you any problem given;
Make any gimcrack, musical or mute,
A plow, a coach, an organ or a flute;
Make you a locomotive or a clock;
Cut a canal or build a floating dock;
Make anything, in short, for sea or shore,
From a child's rattle to a seventy-four;
Make it, said I? Ay, when he undertakes it,
He'll make the thing and the machine that makes it.

4. Thank you, John Lienhard.

5. Analysis sensitive to gender instantly perceives the gender bias in this myth, here noted but not here discussed.

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> And when the thing is made—whether it be
> To move on earth, in air or on the sea,
> Whether on water, o'er the waves to glide,
> Or on the land to roll, revolve or slide,
> Whether to whirl, or jar, to strike or ring,
> Whether it be a pistol or a spring,
> Wheel, pulley, tube sonorous, wood or brass,
> The thing designed shall surely come to pass;
> For when his hand's upon it, you may know
> That there's go in it, and he'll make it go.[6]

Two quintessential Yankee whittling boys, Eli Whitney and Thomas Blanchard, were both born in rural Worcester County, Massachusetts, in 1765 and 1788 respectively. Both became inventors, and both played important roles in the development of the American system of manufactures through their work in the production of United States military muskets. Here is their shared myth, stripped down as closely as possible to its common features.

It is a safe bet that as boys they both had jackknives; in fact we are told explicitly that Blanchard's "first recollections [were] of cutting up shingles with a knife into all kinds of toys, such as windmills, water-wheels, etc." Whitney's sister and Blanchard himself supplied their respective first biographers with anecdotes to demonstrate childhood interest in tools and mild disrespect for parental authority. His sister said Whitney "was always making something" in his father's workshop. He stayed home from church one Sunday to take his father's watch apart to see how it worked, and managed to put it back together without being caught. The boy Blanchard seized a similar unsupervised opportunity to make himself a small forge, fueled it with filched coals, and attempted in vain to weld two pieces of iron together. Neither boy enjoyed farmwork; neither was good at schoolwork. Blanchard even suffered from a severe stutter that made him seem stupid.[7]

Teenage Whitney made nails for sale during the Revolutionary War; teenage Blanchard made tacks at the turn of the nineteenth century. After Whitney belatedly obtained a Yale College bachelor's degree, he invented and patented an improved cotton gin at the age of twenty-eight. Blanchard dropped out of school but invented and patented an irregular turning lathe by the age of thirty-one. Both had trouble defending their patents, but eventually made a success of their mechanical talents: Whitney became a

6. Rev. J. Pierpont, "Whittling—A Yankee Portrait," *United States Magazine* 4 (March 1857): 217.

7. Henry Howe's *Memoirs* contains biographical sketches of both inventors, but his chapter on Eli Whitney is explicitly "condensed from the able memoir by Professor Olmsted" (101) cited below, while for the Blanchard chapter "most of the . . . materials were obtained by solicitation from the subject" (197).

contract manufacturer of military muskets; Blanchard did a stint as inside contractor for musket stocks at Springfield Armory, then continued inventing and managing new patents. Both became famous, Whitney more than Blanchard, and both died well-off and were buried in locally prestigious cemeteries. Replicas of machines associated with both inventors have graced exhibits at the Smithsonian Institution's erstwhile National Museum of History and Technology.[8] Their stories show so many parallels that it seems a common cultural template must underlie them both.

The whittling boy myth appears also to underlie the story of Samuel Colt, who was sent to sea by his exasperated father after too many experiments with explosives. Sam supposedly whittled himself a model revolver on board ship before returning to New England to manufacture arms, fight patent battles, gather fame and fortune, and die young of overwork. Thomas Edison's childhood chemical experiments also feature prominently in his biographies, and we learn of Orville and Wilbur Wright that they never finished high school and became bicycle mechanics before launching their flying machine. Although parallels grow weaker over time, the tool-using boy as father to the inventive man seems to have prevailed in biographies of inventors born in the nineteenth century. Such stories presumably attracted children's attention and encouraged them to engage in inventive experimentation.

Focusing on Eli Whitney's story, we can see that rumor-like processes took place during more than a century of telling and retelling. His heroic inventor myth persists today except among historians of technology, who have evolved a myth of the villainous charlatan Eli Whitney in its place. Here I shall trace the rise of first the hero and then the villain.

Beginning in 1832 (seven years after his death), Whitney biographies divide his career into two parts, one about his 1793 cotton gin invention and subsequent frustrating patent suits, the other about his manufacture of muskets on contract with the federal government from 1798 onward.[9] His cotton gin, which worked better than the earlier roller gin on the kind of cotton grown in upland areas of the South, became during repeated retelling simplified into The (first and only) Cotton Gin, its effect exaggerated into the reason cotton became "king" and slavery persisted in the South, resulting in the American Civil War. By simplification, Whitney's water-powered musket factory became the source of interchangeable parts manufacture; by exaggeration, it became the cause of mechanized mass production of muskets with which the North won the Civil War. Late in the

8. Laurits C. Eichner replicated both Blanchard's gun-stocking lathe and the Whitneyville milling machine for the Smithsonian. See Robert C. Post, "'A Very Special Relationship': SHOT and the Smithsonian's Museum of History and Technology," *Technology and Culture* 42 (2001): 422. The building the Smithsonian erected for the NMHT now houses the National Museum of American History.

9. Dennison Olmsted, "Memoir of Eli Whitney, Esq.," *American Journal of Science and Arts* 21 (January 1832): 201–54.

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nineteenth century, decades after Whitney's death, a fabricated anecdote began describing how Whitney had "demonstrated" the interchangeability of his musket parts to government officials in 1801, and Whitney was named as the first to have used milling machines in arms production.[10] The myth gained detail and color in 1912 when Yale University engineer Joseph Wickham Roe not only credited Whitney with invention of the milling machine by 1818 but also said that he, Roe, had recovered the original machine from the hayloft of Whitney's barn in Whitneyville (fig. 1), the mill village adjoining Whitney's gun factory.[11] This addition strengthened the already prevalent notion of the Whitney Armory as the birthplace of mechanized mass production methods.

A florid but typical account of Whitney as progenitor of modern industry appeared in 1905:

> While success eventually crowned the labors of this dauntless man, he met unforeseen obstacles which would have completely discouraged a less determined person. . . . instead of two years, it took eight to complete the [musket] contract. In all that time, however, the government never lost confidence in Whitney, and at the end of that time [his was] the finest armory in the world for the fabrication of firearms. . . . His machinery and tools were the nearest to perfection in existence. For the first time in the history of the world guns were made whose parts gauged exactly alike, and today that same method of manufacture is followed throughout civilization; not alone in the manufacture of firearms, but in the fabrication of every article that finds its way into the hands of the people, rushing over tracks of steel at a mile a minute; it is proclaimed in the flash and rending crash of engines of war hurling metal bolts whose every part is built to gauge . . . in the pulsation of the horseless carriage sweeping along the way,

10. The first published statement of both of these fabrications, which had developed in the oral tradition, seems to be William P. Blake, *History of the Town of Hamden, Connecticut* (New Haven, Conn., 1888), 138. Blake was a grandnephew of Eli Whitney, a geologist rather than a machinist. Regarding milling, he wrote that Whitney "was the first to introduce and use milling machines in the fabrication of arms." In this he was probably making the same mistaken inference that Edwin Battison corrected in "Eli Whitney and the Milling Machine," *Smithsonian Journal of History* 1 (summer 1966): 9–34, discussed later in this essay.

11. Joseph Wickham Roe, *English and American Tool Builders* (New Haven, Conn., 1916), 142; his three sentences on the subject of milling machines' origins do not mention how he arrived at the conclusion that Whitney "sometime before 1818 . . . built the first successful one." For his reasoning and his retrieval of the machine from Whitney's barn see his article "History of the First Milling Machine," *American Machinist* 36 (1912): 1037. From Roe the old machine was eventually transferred by way of the Yale University Department of Engineering to the New Haven Colony Historical Society, where it remains today.

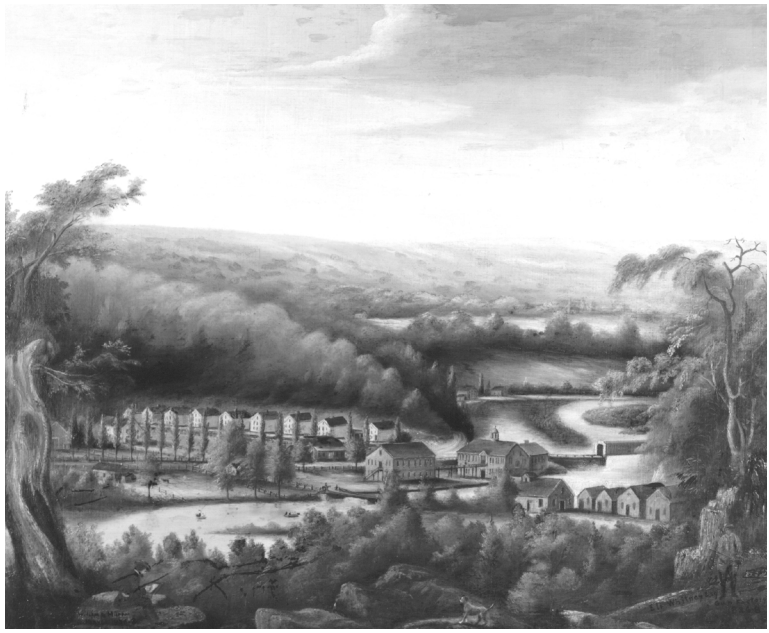

FIG. 1 William Giles Munson, *The Eli Whitney Gun Factory*, oil on canvas, 1826–28. From left to right, the major structures depicted here are the barn, the boardinghouse for single men, nine houses for married workers, two large factory buildings, a forge shop, and four storage sheds. Like the ambiguous pictures used in the study of rumor, this painting of Whitneyville and the Whitney Armory has mirrored observers' own ideas about its subject—showing, for example, social benevolence or social regimentation, billowy trees or billowing smoke from a nonexistent engine. (Courtesy of the Yale University Art Gallery, Mabel Brady Garvan Collection.)

> and in instruments of science, art and song is the genius of the great Whitney proclaimed.[12]

Whew!

In the twentieth century, two book-length biographies of Whitney claimed basis in original documents, both noting that there were gaps in those documents.[13] The fictionalized, nonannotated version by Roger

12. William H. Avis, "The World's Great Debt to Genius," *Connecticut Magazine* 9 (1905): 733–44.

13. Roger Burlingame, *Whittling Boy: The Story of Eli Whitney* (New York, 1941), and Jeannette Mirsky and Allan Nevins, *The World of Eli Whitney* (New York, 1952). Constance McL. Green, *Eli Whitney and the Birth of American Technology* (Boston, 1956),

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Burlingame, titled *Whittling Boy*, appeared in 1941, complete with interpolated conversations and a detailed, dramatic account of the interchangeability demonstration in 1801.[14] By contrast, the copiously annotated nonfiction biography published in 1952 by Jeanette Mirsky and Allan Nevins mentions the demonstration but provides no direct documentation for it.[15] Like other writers, Mirsky and Nevins assumed that when Whitney's letters and probate inventory mentioned milling and milling tools, they referred to the milling machine that Joseph Wickham Roe had brought to light in Whitneyville.[16]

A few years later, however, in 1960, the myth began to unravel when Robert S. Woodbury's *History of the Milling Machine* discussed the existence in 1818 of a milling machine in Middletown, Connecticut, that seemed to be contemporary with Whitney's. Still, Woodbury said, Whitney's miller was superior in design and also the oldest still existing. He praised Whitney's "keen originality" and his "breadth of technical vision in applying the principles of interchangeable parts and specialization of labor."[17] The Smithsonian Institution commissioned and installed a full-size working replica of the Whitneyville milling machine.

Woodbury apparently had second thoughts almost immediately, for in the same year he also published, in the then fledgling journal *Technology and Culture*, an article titled "The Legend of Eli Whitney and Interchangeable Parts," in which he tore the legend to shreds.[18] He debunked the claim that Whitney was the first to think of interchangeable parts for muskets, since Thomas Jefferson had already written home from France in 1785 that

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is one-third shorter than Mirsky and Nevins, influenced by it, and not annotated, although it offers a cogent bibliography of primary as well as secondary sources.

14. Though Burlingame's book is not annotated, he claimed that "Most of the dialogue [was] constructed from letters or diaries" (vi).

15. Mirsky and Nevins, 207, 208. The closest quotes are from a letter by Whitney, which says of his trip to Washington "I carried on a musket of my manufacture & several samples of Locks &c," and a letter by Elizur Goodrich, who writes that "Our friend, Mr. Whitney is here, and has exhibited his Works and Specimens to the President of the United States, the Heads of Departments and many others of superior mechanical information." These hardly substantiate the statement by Mirsky and Nevins that this event was "Whitney's triumphant demonstration of his musket, when by allowing the officials to assemble the parts of the locks—selecting the constituent parts at random—he dramatized the concept of interchangeability" (209).

16. Mirsky and Nevins, 270.

17. Robert S. Woodbury, *History of the Milling Machine* (Cambridge, Mass., 1960), 16–22, quote on 22; his figure 1 shows "Eli Whitney's Milling Machine of About 1820." Woodbury cites E. G. Parkhurst, "One of the Earliest Milling Machines," *American Machinist* (1900): 215–17, for information on the Middletown milling machine in use at the arms factory of Robert Johnson in 1818.

18. Woodbury, "The Legend of Eli Whitney and Interchangeable Parts," *Technology and Culture* 1 (1960): 235–53.

gunsmith Honoré Blanc was making interchangeable musket locks. He pointed to material evidence showing that Whitney's muskets were not in fact interchangeable: gun collectors had taken apart Whitney muskets, mixed up their parts, and found they would not fit back together.

Woodbury also argued that Whitney's detailed probate inventory listed a great many hand files but no machine that could be construed as a milling machine. Further, he complained that when Joseph Wickham Roe saw in the *Encyclopaedia Britannica* that "the first very crude milling machine was made in 1818 at a gun factory in Connecticut," he had merely jumped to the conclusion that it must have been Whitney's.[19] Roe's identification of the milling machine he found in the barn rested only on oral tradition among old Whitney Armory workers.

Finally, Woodbury argued that others—Whitney's predecessors Christopher Polhem in Sweden and Honoré Blanc in France, his contemporaries Simeon North in Connecticut and John Hall in Virginia, and the federal armory in Springfield—were as well or better mechanized and as close or closer than Whitney was to production of interchangeable parts. Therefore we should recognize that his armory could not have been the single source of inspiration for the American system of manufactures in clocks, sewing machines, typewriters, and other consumer durables later mass produced.

Woodbury's rhetoric in this article begins soberly enough, but becomes strangely impassioned, polemical, and moralistic. Questioning whether Whitney had "acted in good faith," Woodbury describes him as an "unmanly" whiner who hoodwinked the federal government into extending his contract while he pursued the elusive rewards of his cotton gin patent instead of devoting full time and attention to arms production, as a patriotic businessman should have done.[20] Rather than unforeseen obstacles and the diminished danger of war with France after 1799, Woodbury saw bad faith as the reason Whitney took ten years instead of two to build his factory, train his workers, and produce ten thousand muskets. Sprinkled with exclamation marks, the article ends with a Victorian-sounding cry from the heart: "[T]he true story of the 'Birth of American Technology' is of prime concern to us. We should make certain that the baby is perfect and legitimate."[21]

The debunking that Woodbury began in 1960 was completed in 1966 by Edwin Battison in his article "Eli Whitney and the Milling Machine."[22] Battison closely inspected the lock parts of some Whitney muskets and

19. *Encyclopaedia Britannica*, 11th ed., s.v. "Tool." In other writings by the author of this entry, it is clear that he was referring to Parkhurst's article about "a gun factory at Mill Hollow, Middletown, Connecticut" not Whitney's in Hamden. See Joseph G. Horner, "Chapters in the Early History of Machine Tools," *Machinery* 16 (November 1909): 190.

20. Woodbury, "Legend," 240.

21. Woodbury, "Legend," 252.

22. Battison (n. 10 above).

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found numbers indicating batch production and fitting rather than production for interchangeability. He also explained why Whitney's only reference to "milling" meant "hollow milling" rather than "true milling" of the sort that could be done by a milling machine. In 1973 he analyzed features of the so-called Whitney milling machine and dated it to 1827, two years after Whitney's death.[23]

The revisionist articles by Woodbury and Battison effectively demolished the heroic Whitney myth among historians of technology, demoting Eli Whitney from Father of the American System of Manufactures to fast-talking arms contractor whose only distinction was his earlier invention of an improved cotton gin. The rumor-like processes that had created the myth were now acting to create a new one, featuring Whitney as charlatan instead of hero.

Citation of Woodbury's article quickly became de rigueur in books and articles about nineteen-century American technology. It was reprinted in anthologies intended for college courses.[24] Its censorious tone carried over into the work of younger scholars. Citing their immediate elders, they continued to deride Whitney for not achieving what his myth said he had achieved, to cast aspersions on his honesty, and, further, to accuse him of producing "wretched arms" and of regimenting his workers' lives.[25] The

23. Edwin Battison, "A New Look at the 'Whitney' Milling Machine," *Technology and Culture* 14 (1973): 592–98. Battison's dating of the "Whitneyville miller" to 1827 hinges on the assumption that James Carrington, former foreman and government arms inspector at the Whitney Armory, had conveyed details of John Hall's "straight" milling machine to machinists there. This he supposed Carrington had done on his way home to Wallingford, Connecticut, after service on the "Carrington Committee" whose report to the government in 1827 vindicated the importance of Hall's work at Harpers Ferry. Having in 1966 ascribed the circa 1818 Middletown miller to Robert Johnson, Battison now argued that it had been built by Simeon North and used at Johnson's factory.

24. The anthology edited by Edwin T. Layton Jr., *Technology and Social Change in America* (New York, 1973), omits Woodbury's notes. Woodbury's article was also reprinted (with notes) in *Essays in American Economic History*, ed. A. W. Coats and Ross M. Robertson (London, 1969), and in *Technology and Culture*, ed. Melvin Kranzberg and William H. Davenport (New York, 1972).

25. For inferred regimentation, see Merritt Roe Smith, "Eli Whitney and the American System of Manufacturing," in *Technology in America: A History of Individuals and Ideas*, ed. Carroll W. Pursell Jr. (Cambridge, Mass., 1981), esp. 52–53, in which Smith elaborates on "Whitney's penchant for social control" on the basis of William Giles Munson's painting of Whitneyville circa 1827, reproduced in the present essay as figure 1. Unlike Smith's book *Harpers Ferry Armory and the New Technology* (Ithaca, N.Y., 1977), "Eli Whitney and the American System of Manufacturing" lacks notes. David Hounshell cites the article as "the best source for the current perspective on Whitney" in his book *From the American System to Mass Production, 1800–1932* (Baltimore, 1984), 349 n. 52. For Hounshell's characterization of "the wretched quality of his arms," see 32; there Hounshell cites Constance McL. Green (n. 14 above), 135–36, but omits her context-setting discussion of defects in arms produced at that time by other contractors and by Springfield Armory.

dramatic interchangeability "demonstration" was now considered proof of deliberate cheating, since it could not have taken place otherwise.[26] (Strangely, no one questioned whether it had taken place at all.)[27] By 1978 Eli Whitney was in such bad odor that participants at a Smithsonian symposium on the American system of manufactures expressed discomfort at finding a large portrait of him on the wall of their conference room.[28] The Smithsonian Institution even stopped exhibiting its replica of the oldest extant milling machine, now apparently tainted by association with the villainized Whitney.[29]

Fortunately, scholarship on the American system of manufactures continued along more constructive paths. Research on the federal armories at Harper's Ferry and Springfield began to unpack and consider separately the characteristics that both the hero myth and the villain myth had considered definitive for the armory system, such as mechanization, gauging, division of labor, and interchangeability of parts. The picture that has emerged shows that the elusive goal of interchangeability in U.S. military muskets made at Springfield itself was not achieved until nearly twenty-five years after Whitney's death, and that handwork with files remained necessary in shaping interchangeable parts long after milling machines had supposedly rendered filing unnecessary—indeed, that both handwork and noninterchangeability persist to the present in private arms manufacture. Successful manufacture of clocks, sewing machines, typewriters, and other nineteenth-century consumer products was not, in fact, due to wholesale adoption of "armory practice," leading inexorably to "mass production."[30] The

26. Smith, "Eli Whitney," 48.

27. No one questioned it in print. Russell Fries, author of "A Comparative Study of the British and American Arms Industries, 1790–1890" (Ph.D. diss., Johns Hopkins University, 1972), questioned it in conversation.

28. Otto Mayr and Robert C. Post, eds., *Yankee Enterprise* (Washington, D.C., 1981), contains revisions of the papers presented at that symposium.

29. The replica is now on display in the Eli Whitney Museum at the Whitney Armory site in Hamden, Connecticut.

30. Smith, *Harpers Ferry Armory*, delves into features of armory practice; Hounshell, *From the American System*, shows it was not adopted wholesale into production systems for typewriters, sewing machines, clocks, McCormick reapers, etc., as had formerly been believed; Robert A. Howard, "Interchangeable Parts Re-examined: The Private Sector on the Eve of the Civil War," *Technology and Culture* 19 (1978): 633–49, examines the persistence of noninterchangeability in nonmilitary weapons, a topic he brings further up to date in his communication "Interchangeable Parts Revisited," *Technology and Culture* 20 (1980): 549–50. Robert B. Gordon, "Who Turned the Mechanical Ideal into Mechanical Reality?" *Technology and Culture* 29 (1988): 744–78, discusses the persistent importance of hand-filing in achieving interchangeability at the national armories. Michael S. Raber, Robert B. Gordon, Patrick M. Malone, and Carolyn C. Cooper take up topics including manufacturing methods, incremental innovation, and gradual adoption of machines in *Conservative Innovators and Military Small Arms: An Industrial History of the Springfield Armory, 1794–1968* (South Glastonbury, Conn., 1989); see also their contri-

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complex interactions of many persons, rather than the genius of particular individuals, are now recognized as necessary objects of study in explaining historical changes in manufacturing technology.

Where has this left Eli Whitney? Among historians of technology, his ghost remains in limbo, for personality—whether heroic or villainous—is out; social construction is in. Recent thorough scholarship has set Honoré Blanc, offstage hero in the debunking of Whitney, into a well-researched context of arms production in France.[31] But no one has cared to study Whitney anew in light of our better understanding of nineteenth-century American armory practice.[32] Thus unexamined, the myth of Whitney as charlatan has persisted in our particular subculture for the past four decades. It functions to distinguish historians of technology from ordinary people.

Meanwhile, in college textbooks for American history, the heroic mythical Whitney has lived happily on, having single-handedly "developed machinery that would mass produce parts that were interchangeable from rifle to rifle."[33] Despite the efforts of historians of technology over the past forty years, even literate Americans generally seem unaware that this myth was debunked; nor have they learned much basic technological history, such as the different characteristics of waterpower and steam power. For

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butions to *IA, The Journal of the Society for Industrial Archeology* 14 (1988), a special theme issue of that journal: Michael S. Raber, "Conservative Innovators, Military Small Arms, and Industrial History at Springfield Armory, 1794–1918" (1–22); Robert B. Gordon, "Material Evidence of the Manufacturing Methods Used in 'Armory Practice'" (23–35); Carolyn C. Cooper, "'A Whole Battalion of Stockers': Thomas Blanchard's Production Line and Hand Labor at Springfield Armory" (36–57); Patrick M. Malone, "'Little Kinks and Devices' at Springfield Armory, 1892–1918" (58–76). The dominance of the American system in American manufacturing is seriously called into question by Philip Scranton's works on flexible specialization in manufacturing, including *Endless Novelty* (Princeton, N.J., 1997).

31. Ken Alder, *Engineering the Revolution: Arms and Enlightenment in France, 1763–1815* (Princeton, N.J., 1997), thoroughly contextualizes Blanc, with appropriate diffidence about the divided reception encountered at the time by several interchangeability "demonstrations" for Blanc's muskets. See chap. 9, esp. 325–27.

32. Among the questions that might be pursued in this new context: why this supposed charlatan continued to be highly regarded by knowledgeable contemporaries and received new contracts in 1812 and 1820; why Whitney in 1806 was offered the job of superintendent of the Harpers Ferry Armory; or on what basis John C. Calhoun as secretary of war is said to have told Whitney in 1822 that his improvements, adopted at both federal armories, were saving the government twenty-five thousand dollars annually. The offer to Whitney to head Harpers Ferry Armory is mentioned in Mirsky and Nevins (n. 14 above), 232, and Smith, *Harpers Ferry Armory* (n. 26 above), 71, both citing documentation. Henry Howe (n. 3 above) paraphrases Calhoun without annotation (127–28), and Carl W. Mitman mentions the twenty-five-thousand-dollar savings in *Dictionary of American Biography*, 2nd ed., s.v. "Eli Whitney".

33. James West Davidson et al., *Nation of Nations: A Narrative History of the American Republic*, 2nd ed. (New York, 1994), 1:358.

instance, one writer interpreting William Giles Munson's painting of Whitneyville and the water-powered armory (fig. 1) has mistaken hillside autumn foliage for smoke from the armory that "like a soldier's shroud casts a somber pall over Eli Whitney's gun factory."[34]

If the effort of technological historians to substitute history for legend has not yet prevailed, it may be neither because we have failed to disseminate our findings, nor because the subject matter is complicated and ambiguous, but rather because myth has power to convey not specific facts but deeper truths. Consider the generic whittling boy myth underlying the stories of Whitney, Blanchard, Colt, et al. It says that a child, "by his genius and his jack-knife driven," learns to invent by using real tools to shape objects in the real world. But has the whittling boy given way in today's Information Age to the sedentary computer whiz creating a virtual reality? Can "inventive minds" short-circuit the use of hand tools in childhood? Not according to a two-page newspaper advertisement for Hewlett-Packard that appeared early in 2000. The first page of the ad shows a curly-headed boy in shorts and jacket standing in front of a brick wall and shyly displaying a propeller-equipped wooden gizmo he has made. In large type the ad proclaims, "All kids are inventors." The second page explains that all kids are inventors "because they're not afraid to get their hands filthy. To eat the paste. To use a hammer as a brush. To break something just to see how it works. And to start with the impossible, which is where grownups usually stop."[35] The well-dressed but rumpled urban kid shown in the ad has not made a computer-aided design, but an actual gimcrack that goes. We may suppose that this modern-day whittling boy has a jackknife in his pocket, and that he will grow up to be an inventor.

Eugene Ferguson and Brooke Hindle have written about the importance of visual or nonverbal thinking in design, invention, and technological problem-solving.[36] Implicitly including kinesthetic as well as visual apprehension, their theme draws attention to the importance of the hand in the development of the human brain. That manipulation and observation of real things as a child is necessary for invention is also implicit in the whittling boy myth. Perhaps magnetic resonance imaging studies of neural activity in the brain will someday be able to test the connection. Meanwhile, whether universal truth or time-and-culture-bound belief, the connection informs the whittling boy myth, and may help explain its persistence.

Thirty years ago (a generation, by traditional count), Edwin Layton

34. Richard B. Morris, ed., *The U.S. Department of Labor Bicentennial History of the American Worker* (Washington, D.C., 1976), 226.

35. *Wall Street Journal*, 25 January 2000.

36. Eugene S. Ferguson, *Engineering and the Mind's Eye* (Cambridge, Mass., 1992); Brooke Hindle, *Emulation and Invention* (New York, 1981).

observed that "one of the most important tasks of the first generation of critical scholars in any field of history is to debunk the myths and legends that encrust the records of the past. The study of American technological development is no exception."[37] Might the present generation now move onward, to view myths and legends about inventors not merely as false history but as stories from which to learn about the storytellers?

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37. Layton (n. 25 above), 5.