THE AMERICAN IMAGE OF TECHNOLOGY FROM THE REVOLUTION TO 1840

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IN 1797, AMOS WHITTEMORE PATENTED A MACHINE FOR USE IN TEXTILE MANUfacture. John Randolph could only comment: "All but the immortal soul."[1] In post-Revolutionary America, the idea of technology captured the imagination of the newly liberated citizens, embodying advances in knowledge and the awakening of human potential. The possibilities of science and technology were thought to be limitless, leading to material independence, intellectual understanding, wealth, control over the forces of nature and the reanimation of agriculture. Perhaps this was partly the myopic vision of the naive, but it was also the optimism of the patriot who linked the potential of technology to the potential of America. With the English example before him, the American apologist for technology recognized the misery of industrialization, but thanks to American republicanism, the feasibility of decentralization, initiative and the belief in self-determination, mechanical technology could exist in purity in America, serving to strengthen values and fortify the nation. The early American perception of technology prompted an aesthetic response, raised economic questions and involved political issues, but all of these elements, in the final analysis, formed part of a concern for national direction and purpose. The image of technology was concomitant with the image of America, and in the early years of the new nation both were positive.

For intellectuals influenced by the promises of the Enlightenment, science had been accepted as the way to knowledge and an intimate, if not absolute, understanding of the universe. As scientific principles were applied to practical problems, machinery appeared to revolutionize the visible world and the way men, women and children functioned within it. More specifically, machinery greatly affected the production of manufactured goods and the practice of the "useful arts." This brought about such change that Jacob Bigelow, holder of the first Chair of the Application of the Sciences to the Useful Arts established at Harvard in 1812, resurrected the term "technology" from old dictionaries in his efforts to provide a more suitable vocabulary for the new developments. Indeed, in 1829, Bigelow published his lectures as *Elements of Technology* in an attempt to facilitate public education about those new inventions and discoveries which he believed were "promoting the benefit of society together with the emolument of those who pursue them."[2]

The term *technology* embraces diverse processes and objects and, according to David

Jeremy, includes "operating formulas; implements and machinery; patent specifications, drawings, plans and verbal descriptions; models and parts of machines; arrangements in the organization and management of production; and human skills."[3] This paper is concerned with the way Americans saw, described and intellectually dealt with the new mechanical technology as a dynamic agent of change. This is not a study of any particular machinery or process, but rather of the ideas that were evoked by the introduction of new technology. More specifically still, this paper examines the way in which the idea of technology was expressed in nationalistic terms. As it appeared in early mills and factories, mechanical technology represented a departure from the heavy reliance on agricultural production for economic strength as well as cultural identity. Accordingly, many of those in the forefront of promoting the new technology were concerned with its connection with manufacturing—one of the most visible and influential fields for mechanization. Although a new mill or steam engine appeared only gradually, its very appearance was enough to raise interest, to stimulate the imagination, and to encourage the nationalist.

Those responding favorably to the new technology were not surprisingly the entrepreneurs and the moneyed interests—including Federalists such as Alexander Hamilton and Tench Coxe—and practical men such as Jacob Bigelow, but also old agrarians like Thomas Jefferson and men who supported the application of the new technology to agricultural problems. Men from all walks of life saw technological development as indicative of America's national future, and perceived this change in accordance with their particular expectations and hopes for America. This study, then, also pursues the political beliefs connected with the new ideas. Much of the discussion surrounding the rise of manufacturing, for example, was concerned less with the actual machinery or processes, than with the political and fiscal policies that encouraged their growth. Those individuals in the early national period concerned with economic, political and ideological development saw the impact of technological innovation as central to their arguments.

American responses to technology reflected growing concern for national direction. What sort of country was America to be? How was it to maintain independence after initial severance from Britain? How could the promise of America be best achieved and least damaged? How could the ideal be realized? Hugo Meier has recognized the implications of this concern for national direction by viewing technology as part of America's international military and commercial relationship, and more effectively as a function suited to a democratic society.[4] John F. Kasson has pursued the same question in his study of the relationship between technology and the broad notion of republicanism.[5] Although these historians have linked technology to the rise of specific American ideas, the association should be taken much further. The intellectual role of the image of technology goes beyond any single political philosophy to the reality of independence, the endorsement of enlightenment science, and the widely held belief in progress. The machine was believed to be the vehicle of American success and the best expression of her rapid advance. The guidelines for study have been set by the early historian of technology, Brooke Hindle, who has argued for the

recognition of "the enthusiasm of the early American craftsman, mechanic, and engineer." "Unless the historian can catch some of that spirit," continued Hindle, "he will render a better service by studying some other field."[6]

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America did not automatically achieve stability after the Revolution, nor for that matter after the ratification of the Constitution. The American image of technology existed within a context of economic fluctuation and intellectual excitement, for the United States was defining her position under independence. The rhetoric of nationalism was symptomatic of a desire for unity, direction, and articulated purpose. Not unexpectedly, much of this rhetoric was still linked to the language and sentiment of revolution. In 1787 Benjamin Rush addressed the people of the United States in a petition that expressed the wide-ranging impact of revolutionary philsophy and implied the need for vigilance: "Hear her proclaiming, in sighs and groans, in her governments, in her finances, in her trade, in her manufactures, in her morals, and in her manners, 'THE REVOLUTION IS NOT OVER'."[7] America needed political solidarity, economic development, and intellectual definition. In the minds of apologists, technology was to affect all three as a visible, potent force, because it symbolized the dynamism demanded of America.

The needs of a military revolution naturally had stimulated the growth of local technology, especially for the provision of firearms and the manufacture of cloth for general wear as well as uniforms.[8] By severing political and legal links with Britain, the Revolution had on one hand released America from those restrictions to manufacturing introduced as measures of British mercantilist policy, for "even the great Mr. Pitt . . . was against permitting so much as a hob-nail to be made in the colonies," but on the other it put a temporary halt to English imported goods.[9] The Revolution had forced America into economic isolation, thereby providing a tangible impetus to the encouragement of native technology as well as forging a significant symbolic association. "The very powder which generated the thunder of our cannon was sometimes British manufacture," lamented writer George S. White, "and the 'striped bunting' may often have been from the same loom with the 'cross of St. George' . . . such a state of things could not but awaken the spirit and enterprise of Americans. Amidst the agitation of war, while one part of the population was ranging itself under the military banners of our country, another devoted itself to her interest in another form."[10]

The rise of manufacturing and the American Revolution were more than contemporaneous; they were conceived of in synonymous terms. George White imbued manufacturing with those American values, heroic associations and direct links to the divine normally reserved for the Revolution. Textile entrepreneur Samuel Slater was accorded the heroic proportions of George Washington. "We have reason to be thankful that his footsteps were directed to America," crooned White:

> that it was put into his heart to visit these shores, for the purpose of introducing the cotton spinning into the United States; without which we never could have maintained our independence. . . . Its establishment is therefore one of the greatest events that has yet taken place in the whole world, and will in the end be the means of revolutionizing the whole inhabitable globe.[11]

The success of the Revolution was traced equally to the fighting and the manufacturing machine. Moreover, if the impact of independence was to continue, the promotion of American manufacturing needed to be an ongoing thing. To this end, the wearing of "homespun," or locally produced cloth, remained an exercise in patriotism. This was made very clear in an advertisement for a cotton manufactory in 1809 which carried the line: "The patronage of the patriotic, who wish to encourage home manufactures, as well as of those who, by purchasing the most durable articles, consult their own emolument, is solicited."[12]

George White, in very romantic terms, viewed science and technology as part of the Revolution's success, but others considered machinery as simply aesthetically pleasing, a creation of precise beauty possessed of lifelike qualities. So strong was this attitude, that John Adams could use mechanical artistry to describe the Revolution and so invoke the impression of perfect harmony: "Thirteen Clocks were made to strike together—a perfection of mechanism which no artist had ever before effected!"[13] Similarly, mechanics manual author Zachariah Allen could write in 1829, "The skill of modern artists seems almost to have endued [*sic*] wood and iron with a degree of intelligence, in the surprising operations accomplished by various machines."[14]

Although some arguments in favor of manufacturing were based on romantic notions, others made use of the rationalist philosophies that were also used to justify the Revolution. To this end technology was seen as the way to understand nature with a new promise of accuracy and a sense of grandeur that was not the mysticism of the Romantic, but the wonder that stemmed from rational knowledge. The influence of scientific reasoning permeated political economy. When America possessed abundant natural resources it appeared both improvident and irrational to continue a staple export policy. If discoveries in science had uncovered economy and purpose in nature then the same principles should hold valid in those other systems also deemed to be open to scientific inquiry and control.[15] "Conduct not yourselves, therefore, my countrymen," urged the *American Museum,* "as if you believed that nature bestowed on one country what ought to be given to another, which absurd idea would be chargeable on you, for your spurning at her gifts, by either wholly neglecting them, or sending them abroad to be manufactured. How contrary this to the dictates of common reason."[16]

To import native materials in a processed form meant to some that America courted low economic status, reducing self-sufficiency and stagnating industrial potential merely to satisfy Jefferson's outmoded doctrine to "let our workshops remain in Europe."[17] Such a policy, they argued, failed to take advantage of the entrepreneurial qualities

of America's own people and those she attracted as immigrants. Textile manufacturers such as Francis Cabot Lowell, Nathan Appleton, P. T. Jackson and Samuel Slater all recognized the prosperity to be found in bringing the raw materials and the mechanical process of manufacture together on American soil. Their efforts to that end are significant in reflecting the capacity of textile manufacturing to support large-scale operations which, James Henretta has argued, yielded the nonagricultural sector a higher rate of earnings and indeed "made possible a dramatic rise in the gross national product."[18]

Apologists for manufacturing believed the process to be profitable for the individual, and indicative of economic power and progress on a national scale. Mathew Carey, publisher and charter member of the Philadelphia Society for the Promotion of National Industry, evoked Britain as a provocative comparison, for it had achieved economic supremacy on the world market. "Take from England her manufactures," wrote Carey, "and the fountains of her wealth would be lost forever."[19] The political economist Tench Coxe pursued the same point with a more poignant subtlety, by comparing Britain with Ireland. In this analysis, prosperity, power and independence were the products of a manufacturing economy like that of Britain, while Ireland, the predominantly agricultural nation, remained insignificant. Coxe thereby was implying that Americans should not wish their country to become another Ireland, poor and unable to counter British oppression.[20]

The pursuit of wealth through economic development did not overshadow a concern for morality. Manufacturing was thought to be the "road to wealth," but it also was considered the "harbinger of moral and intellectual improvement."[21] These expectations for manufacturing were part of what Kasson has termed "a deep, even anxious concern to hold true to course."[22] Reminiscent of the Puritan jeremiad, the image of technology—and of manufacturing in particular—encompassed a call for continued vigilance in order to rediscover the frugality, virtue and simplicity that indicated the success of republicanism. Native American manufacturing was considered by many to be the spiritual link with 1776 and the best means to combat the enemy of the Republic—luxury, "the effeminate debaser of the soul, the corrupt impoverisher of the mind" and "the vicious parent of innumerable evils."[23]

For a long time, observers upheld America as an example of purity and innocence, yet this notion did not necessarily stem from romantic Virgilian pastoralism. For some, it was not rural simplicity which was to save America from luxury's contamination, but native manufacturing. They argued that this would prevent the excessive importation of foreign goods, reduce debt to overseas nations and limit the cultivation of extravagant lifestyles. Opposition to British imports was seen, therefore, not only as an effective economic move, but a policy of national security and republican purity. Lamented Hugh Williamson: "when we encourage luxury, it is to enrich another nation, and to make our own citizens poor. Can there be a greater treason committed against the states!"[24] The encouragement of manufacturing went to the very heart of the American political experiment. In 1819, for example, the Philadelphia Society for the

Promotion of National Industry feared that if manufacturers or mechanics failed in business or if town dwellers remained unemployed their "attachment to our government [was] liable to be impaired," and disaffection would result.[25] The Society warned that "numbers of our citizens, possessed of valuable talents and disposed to be useful, but unable to find employment are migrating to Cuba, where under a despotic government, among a population principally of slaves, and subject to the horrors of the inquisition, they seek an asylum from the distress they suffer here!"[26] This was a disappointing slip from Benjamin Rush's positive view of America as "the only assylum [*sic*] for liberty in the whole world," where, "by establishing manufactories we stretch forth a hand from the ark to invite the timid manufacturers to come in."[27]

The encouragement of manufacturing had even more important implications for those who looked to the international impact of America's revolution and saw a connection between a fall in economic prosperity and an apparent reduction in real independence. The Philadelphia Society for the Promotion of National Industry saw the encouragement of manufacturing as an issue upon which depended 'the future destinies, not only of this country, but of a large portion of mankind, whose fortunes cannot fail to be deeply affected by the result of our experiment of free government."[28]

Americans were encouraged to consider the importance of maintaining the independence which had been achieved. To rely on the importation of manufactured articles which could be produced at home was thought tantamount to subjugation and thus contradictory, if not destructive to the philosophy of the Revolution. "It is the cause of the nation," announced the Philadelphia Society for the Promotion of National Industry, "It is the might question, whether we shall be really or nominally independent."[29]

The need to create a realistic and thorough independence stimulated an assessment of the international status of American society throughout the country. Americans deliberated about the possession of raw materials, the size and nature of the labor force, the expectations and desires of the people, and most importantly the potential of America to hold a strong position in the world. The Pennsylvania Society for the Encouragement of Manufactures and the Useful Arts made the link between domestic conditions and international standing quite clear in the reasons it presented for the formation of such a society.

> The United States, having assumed the station of an independent government, require new resources to support their rank and influence both abroad and at home. Our distance from the nations of Europe,—our possessing within ourselves the materials of the useful arts, and articles of consumption and commerce,—the profusion of wood and water, . . . the variety of natural productions . . . the number of people in our towns . . . whose education has qualified them for employments of this nature,—all concur to point out the necessity of our promoting and establishing manufactures among ourselves.[30]

Societies aimed to spread information about technology, refute opposition, establish

factories from their funds, and lobby for legislative assistance. By far the major issue of contention surrounding the encouragement of technology was this last aspect. Should technology receive government assistance in terms of protective duties? How much control should government have? What effect would protection have on the agrarian interests? Would this lead to the polarization of sections?

Both state and federal government had taken quite distinct stands regarding the place of science and invention. Article 1 Section 8 of the Federal Constitution provided for the security of patents to promote "the Progress of Science and Useful Arts," while the First Session of the First Congress passed a Tariff Act. The Act dealt in very basic terms: "It is necesary for the support of government, for the discharge of the debts of the United States, and the encouragement and protection of manufactures, that duties be laid on goods, wares and merchandizes imported."[31] The Congress, however, continued to be petitioned for broader and deeper protection, especially in the years immediately following war and during times of commercial slump. Protective tariffs were clearly nationalistic policies which forcefully endorsed a popular belief that America needed to develop self-sufficiency in manufactured items.

The state legislatures also acted in response to specific petitions for assistance. Calls came from societies and individuals to provide loans for manufacturing ventures, to promote specific industries, to authorize land improvements, or to incorporate and grant aid to societies. In every case the acts were referred to in similar language. Manufacturing involved "laudable purposes" and "patriotic intensions" and was "closely connected with the public weal" and "conducive to the Public Interest." Hence, the "duty of the legislature" was to offer support and real encouragement.[32] The development of "internal improvements," especially roads and canals, resulted from this support. Such legislative assistance meant tremendous geographical expansion as well as the opening of new resources, especially interior coal fields (the Lehigh Valley in Pennsylvania being a most prominent example). Those involved with promoting internal improvements were well aware of the government's positive role in what was undoubtedly a stimulus to technological development. John Ruggles Cotting, for example, in his *Report of a Geological and Agricultural Survey, of Burke and Richmond Counties, Georgia,* made particular reference to this role, and of his survey added: "it was undertaken under the administration of an enlightened and patriotic chief magistrate, one who duly appreciates the application of science to art."[33]

It seems clear that considerable public opinion was mobilized for technological progress. It is also evident that machinery for this support existed in specific societies and was encouraged by state and federal law. At the popular level, technology manuals appeared on the market to keep an interested public abreast of change as well as to inform the increasing numbers moving into technological fields. The list of such manuals is long and varied, from almost encyclopedic works such as Bigelow's *Elements of Technology* or Thomas Green Fessendon's *The Register of Arts,* to more specific offerings such as S. H. Long's *Rail Road Manual,* Oliver Evans's *The Young Mill-Wright & Miller's Guide* or Zachariah Allen's *The Science of Mechanics.*[34]

Within such popular affirmations of the pro-technology position is a clear statement

of American national interest. Allen, for example, made specific reference to "the recent improvements in machinery" as having "advanced manufactures to a high relative rank in the scale of national interests," while making it very clear that "the science of Mechanics" was now a subject of interest and importance for every American.[35] Such calls for unity were common among apologists, but one must ask questions about the role of sections and political diversification in formulating attitudes towards the rise of new technology. It is perhaps most effective to approach this angle through the experience of Thomas Jefferson. Although Jefferson always admired science and technology, especially gadgetry, he feared the consequences of an industrialized America. He set forward this view in the much-quoted query nineteen from the *Notes on the State of Virginia:*

> Those who labour in the earth are the chosen people of God, if ever he had a chosen people, whose breasts he had made his peculiar deposit for substantial and genuine virtue. It is the focus in which he keeps alive that sacred fire, which otherwise might escape from the face of the earth. . . . While we have land to labour then, let us never wish to see our citizens occupied at a work-bench . . . let our workshops remain in Europe.[36]

This statement represents deep concern for American frugality and independence from the pattern of European development, but it is also a statement issued in response to singular conditions, including the criticisms of Buffon. When Jefferson advocated agrarianism, America had not yet been affected by the French Revolution nor the War of 1812. To cultivate agriculture and "commerce as its handmaid" was a practical policy for a developing nation with ample lands and a seafaring knowledge.[37] At a time when Europe was racked with dissension and distress through land enclosure, primogeniture and entail, the open lands of America seemed the panacea. Each citizen possessed a literal interest in the nation if he was—or thought he could become—a landowner. Agrarianism developed into a political philosophy from practical considerations, but also from a belief that an established farming population was the best means to secure American independence, republican prosperity and national virtue. Jefferson believed corruption stemmed from dependence and "mobs." This fear formed the basis of his agrarianism, for Jefferson's query nineteen also stated: "Dependence begets subservience and venality, suffocates the germ of virtue, and prepares fit tools for the designs of ambition. . . . The mobs of great cities add just so much to the support of pure government, as sores do to the strength of the human body."[38] Jefferson could speak of Washington City as "the fairest seat of wealth and science," but the industrial city remained incongruous and unacceptable.[39] Jefferson could only support that which strengthened the Republic. Manufacturing belonged in this category, but not if it resulted in creating American Manchesters.

When Jefferson announced his policy of embargo as a response to British encroachments on the liberties of American seamen and shipping, he simultaneously favored the national development of manufacturing for the same reasons he had advocated agrarianism: independence, republican prosperity and virtue. He thought of

agrarianism as a bastion against the tyranny of the mob, but now the English tryanny was greater and this demanded the development of native industry. He recognized agrarianism as "theory only, & a theory which the servants of America are not at liberty to follow," but he believed the principles behind the theory needed to survive.[40] The fact that he made this statement as early as 1785 suggests that even then, Jefferson recognized pastoralism as an ideological expression of Americanism, but he also saw that it was hardly adequate and certainly not comprehensive.

There exists no real contradiction, then, between Jefferson the agrarian and Jefferson the scientific rationalist, for the concepts expounded by each—virtue, truth and independence—were the same. The purity Jefferson saw in agrarianism also existed in the works of the enlightened scientists and rational thinkers, and could be molded into the total expression of the American intellectual experience. When Locke spoke of the state of Nature, he referred to a philosophically innocent condition and it was this intellectual state that Jefferson sought in both American agriculture and science. Locke, not Virgil, belonged in Jefferson's revered "trinity." Republican virtue was a state of mind that could be expressed in pastoralism, but it was also a larger quality that essentially transcended this one expression.[41] When the occasion arose, Jefferson could see the preservation of the natural mind even in domestic manufactures.[42]

According to Jefferson, political theory and social procedure, like all scientific exercises, were empirical. In a letter to Benjamin Austin in 1816, Jefferson confessed that "no one axiom can be laid down as wise and expedient for all times and circumstances," and so he traced the changes in his thoughts on manufacturing as commensurate with the altering fate of America. He began by seeing the agrarian philosophies he espoused in *Notes on the State of Virginia* as no longer applicable to American conditions, saying "Within the thirty years which have since elapsed, how are circumstances changed! We were then in peace. Our independent place among nations was acknowledged." He recognized the need to revise his policies with the onset of war, for "experience has taught me that manufactures are now as necessary to our independence as to our comfort." To maintain and strengthen the Republic, he argued: "We must now place the manufacturer by the side of the agriculturist."[43] Jefferson's support went beyond acquiescence to positive endorsement, when he wrote to Dupont de Nemours: "The advantage is too sensible ever to be relinquished. It is one of those obvious improvements in our condition which needed only to be once forced on our attention, never again to be abandoned."[44]

If Jefferson advocated manufacturing, yet stood in opposition to Hamilton's attempts at promotion, the political debate must be approached in terms of the principles that differentiated republicanism from federalism and consequently the way in which manufacturing became entangled in theories of government and philosophies of political responsibility. It must also be viewed in the context of a nation in the precarious position of emerging from revolution and creating a new political system with form and function peculiar to a unique situation.

Post-Revolutionary American political culture was far from homogeneous. Even the caution of the Constitution may be viewed as a product of factional compromise.

The Revolution had not spawned a nation but a confederation. The Federalists soon emerged to direct and unify this conglomeration of states, factions and interest groups—both politically and economically. They justified their demands for a strong central government and singular control of the economy by their pessimistic view of human nature. The passions were still the masters of men, and, therefore, the system of government must be well protected from the volatile mob, while the executive must be allowed to exercise benevolent power. It depended on the view that America was little different from any other country: human nature remained imperfect even in a new world. Wrote Hamilton of the problem and its answer: "Is it not time to awake from the deceitful dream of a golden age, and to adopt as a practical maxim for the direction of our political conduct, that we, as well as the other inhabitants of the globe, are yet remote from the happy empire of perfect wisdom and perfect virtue?"[45]

Federalists employed these ideals in a controversial fiscal policy. As Secretary of the Treasury under Washington, Hamilton proposed nothing less than a comprehensive and totally integrated economic system that had seismic ramifications. The program was aimed at ensuring independence by manipulating the public debt to create credit and stimulate investment, a process that had been practiced in England. Protective tariffs would encourage diversified production and market growth. Government protection of manufacturing was therefore crucial.

In 1791, Alexander Hamilton, aided by Tench Coxe, presented a Report on Manufactures to the House of Representatives. The report established the need for economic independence, outlined the prospects for employment and wealth, and encouraged American enterprise and the utilization of natural endowments. It courted the agricultural interests by referring to mutual assistance while demonstrating the improvidence of a myopic economic policy. This document presented manufacturing as insurance against national vulnerability, because, as the authors argued, the base of domestic production would be widened.

The importance of the Report is its politicization of the positive image of manufacturing. For a number of years, Tench Coxe and Mathew Carey had been publicizing the multidimensional value of economic diversification, but this report offered a systematic policy. Hamilton transformed the image into a method by advocating pecuniary inducements, import restrictions and, above all, protective tariffs.[46] The protection issue was seen by Carey as a national question, for it was really the future of America under discussion. He believed the issue involved "the prosperity of this country in all its departments of industry, agriculture, trade and commerce, as well as manufactures, and that therefore this was not a sectional or manufacturing but a great national question."[47] This report, however, was not revolutionary; in fact, it merely systematized longstanding opinion and it applied a financial policy already under debate. Any controversy was not over manufactures but rather over the fiscal policy of which it was a part, and Federalist philosophy, of which it was an expression.

Those who came to oppose Hamilton feared a restriction upon the liberties they had demanded from the Revolution. Many did not thoroughly understand the fiscal policy and believed it simply would harbor economic favoritism at the expense of the

agrarian interest, the small individual worker and the southerner. They feared social and economic division would occur, if it didn't already exist. The debate over the ramifications of protection continued well into the nineteenth century. Southern Congressman Churchill Cambreleng, writing in 1821 under the pseudonym "One of the People," argued from the agrarians' stand against economic favoritism. If the proposed system was adopted, argued Cabreleng,

> it must gradually transfer the legislative power in this country from the farmers to the manufacturers. . . . The manufacturers of the United States will, it is hoped, always share with every other branch of industry, the parental care of the government; but we must also hope that no particular branch will ever be made the favourite, by a government instituted to do equal justice to men enjoying equal rights.[48]

Those who opposed protective legislation to encourage manufacturing did so because they believed fiscal manipulation was artificial and would prove detrimental to economic and social balance. Above all, they feared monopoly and power, because if a system could only be operated by a tremendous wielding of influence, then dependence and corruption would surely be the result. Attitudes were polarized and sectional, for Republicans believed in the value of decentralized government and state independence, a faith with which they entered the contract of the Constitution. They considered the fiscal policy to be the unconstitutional usurpation of that faith.[49] Similarly, they believed the establishment of an economic elite would magnify and cultivate the powers of capitalism and control of the masses, for Federalism was thought city-based and northern-oriented. Yet agrarianism was similarly associated with an economic power block—the southern elite. Indeed, Tench Coxe was at pains to placate the southerners in his "plan of manufactures" by cultivating the notion of mutual self-interest. Growth in the manufacturing sector, he argued, meant an increased demand for those raw materials supplied by the southern states.[50]

Coxe was acutely aware of the need for unity as he vindicated his position in almost conciliatory and pacific terms. "The sole aim of this . . . work, is to elucidate, unite and promote the various interests of the American family," argued Coxe in 1810, "whether agricultural, mercantile, manufacturing or auxiliary, in the north and the south, in the east, in the west, and in the centre."[51] Similarly, when he and Hamilton proposed the Report on Manufactures, they specifically aimed to quell fears based on the ability of the American economy to support diversification, the wisdom of massive speculation, but also the threat to the singular position of the agricultural producer.

The rise of manufacturing represented a transfer of economic power and hence political control, but it did not represent the death of any romantic American virtue. As Kasson has rightly recognized: "The popular image of Hamilton, encouraged by some scholars, as a Machiavellian figure who smuggled in the blueprints of American industrialization behind the backs of an idyllic and unwary nation of farmers wildly exaggerates not only Hamilton's personal character but the thought and character of

the rest of the nation as well."[52] The nature of political differences and the related intellectual boundaries of the manufacturing issue were made clear in the *National Recorder:* "We are not adverse to manufactures in this country, but abhor the interference of government in directing our plan of acquiring wealth" and then "On no subject of national interest is there such unanimity as the propriety of encouraging domestic manufactures."[53]

Although technology, in the form of mechanized manufacturing, was undoubtedly well received, it is naive to suggest this positive response was the only one. Opposition was not always based on a romantic pastoral image, nor was it necessarily aesthetic or moral. On the contrary, opposition to manufacturing very often reflected attitudes of self-interest linked to a fear that the power technology engendered would unbalance existing political and economic relationships. Arguments of opposition also demonstrated a rational and analytical understanding of the American social, demographic, and economic status quo. "The objections to the pursuit of manufactures in the United States," argued *Niles Weekly Register* in 1813, "represent an impracticability of success, arising from three causes—scarcity of hands, dearness of labour, want of capital."[54] Yet it was the peculiarity of American circumstances, especially what may have been deemed a labor problem, which was to stimulate the world-renowned American System of Manufactures. This placed a premium on inventiveness and initiative to design labor-saving devices. "The high price of labor in the United States," explained Zachariah Allen, "Has had a tendency to direct the genius of the people to all descriptions of mechanical inventions, from the simple apparatus for paring an apple, to the machinery for propelling a vessel of war."[55] These qualities went hand in hand with what Samuel Rezneck termed an "industrial consciousness," an idea which John Sawyer later saw included intangible features such as "mobility, flexibility, adaptability . . . belief in progress . . . originality, systematic effort, and boldness; the 'eager resort to machinery' and productive use of small capital."[56] Even those circumstances which some believed would restrict the development of manufacturing, and hence justified its opposition on the grounds of ineffectiveness, proved to be those very conditions that turned American technologists to a more inventive and ultimately more efficient use of machinery.

Even so, Americans were still aware that probity should be cultivated along with technology. While the machine could be controlled and used by Americans, while it could exist in harmony with American principles and not disrupt the standards of the community, it was believed to offer countless advantages. The image of technology which was developed in this period did not, therefore, include industrial cities as necessary or inevitable; rather manufacturing was viewed as decentralized, localized and essentially pristine. Early exponents were not ignorant of the evils of industrialization, urbanization or class structures, but they saw the machine in a purity that stood aloof from abuse. Henry Clay made the position quite clear:

> The opponents of the manufacturing system transport themselves to the establishments of Manchester and Birmingham, and, dwelling on the indigence, vice, and wretchedness

> prevailing there, by pushing it to an extreme, argue that its introduction into this country will necessarily be attended by the same mischievous and dreadful consequences. . . . But if we limit our efforts, by our own wants, the evils apprehended would be found to be chimerical. . . . A judicious American farmer, in the household way, manufactures whatever is requisite for his family. He squanders but little in the gewgaws of Europe. He presents in epitome, what the nation ought to be *in extenso.*[57]

The apologist's faith rested in the overwhelming possibilities for American improvement and the knowledge that an availability of land reduced the threat of the machine centralized in cities. What is more, American manufacturers relied heavily on water to generate power. In his study of the introduction of steam engines, Peter Temin concluded that "although steam power was used wisely in manufacturing by 1840, most of its use was concentrated in a few industries and it provided the main power supply for almost none."[58] Because of the demands of location, mills were forced to be decentralized, and the seats of American industry were kept contained in size and largely free of the grime associated with heavy coal use overseas.

It was argued that, in Britain, poverty, class antagonism and city slums were not caused by manufacturing itself but by British management, national philosophy, and a misuse of energy and power compounded by overpopulation and economic inflexibility.[59] According to Benjamin Rush "many of the diseases to which the manufacturers in Britain are subject to are brought on not so much by the nature of their employment, but by their unwholesome diet, damp houses, and other bad accommodations, each of which may be prevented in America."[60] Therefore, Americans were safe while they resisted urbanization and believed that the quality of life could be controlled.

This view of American industrial enterprise as somewhat pristine and controllable is implied in the architecture of early manufacturing buildings, especially those associated with textile production. The mills themselves, described by architectural historian William H. Pierson as "immense and muscular," were "organically expressive of a youthful and aggressive technology," but they stood separate from the housing for workers which consisted of freestanding cottages "in no way related to the larger scheme of the mills and their waterways."[61] Although this lack of unity in design decreased with the rise and development of the manufacturing town, Pierson has still argued that worker housing was "humanized" by variety and the individual touch.[62] In its infancy, then, American factory housing reflected the position of the early industrial worker; his labor was courted rather than exploited. Labor was in short supply; it was expensive; it was mobile, in both economic and geographic terms; and perhaps largely as a consequence, American manufacturing was never as labor-intensive as its English counterpart.[63] During the early years of industrialization the American manufacturer was encouraged to be generous by economic reality and popular ideology.

American expectations were high, for faith in enlightened reason had reduced excuses for failure. "It is true," explained George S. White, "that the abuse of these institutions may produce bad results, but the abuse is no argument against the thing itself.

. . . But while a love of virtue and liberty remains, these institutions will be cherished with confidence and advantage to the whole community."[64] It is clear, finally, that manufacturing itself did not cause the intellectual dilemma raised by the broader issues of national growth and economic policy. Urbanization, "the mob," the decadence and distress of the British manufacturing city were all seen as products of a development that had outgrown or overcome the controls of society. When Clay spoke of a need to "limit our efforts" and White of bad results from abuse, they were not condemning manufacturing, but rather expressing concern at unsupervised growth. It is important to recognize that they did not advocate pastoralism to maintain purity, nor economic stagnation, nor a rejection of mechanical innovation, but rather that they acknowledged American growth and development needed vigilance to eliminate unwanted consequences. The introduction of manufacturing was not an issue because agrarianism as the only economic path was becoming less and less viable. National loyalty, especially as this involved the preservation of independence, demanded endorsement of the new technology, while simultaneously calling for care in its growth. Perhaps it is for this reason that apologists of technology were so keen to link it with probity, republican virtue and American direction, because to do so would be to maintain control.

Post-Revolutionary Americans believed that self-determination was possible in any given situation, so exponents of manufacturing could have confidence in the quality of operations. They could ensure a set standard was maintained. For example, advertisements for workers in the new industries expressed their concern for standards by referring to the moral character of applicants before and during employment.[65] This indicated a demand for model workers, but it also publicized the manufacturers' desire to maintain pristine standards, and not to be seen as contributing to social decline on the English model. Timothy Dwight, president of Yale College, keenly recommended Humphreysville in 1811 for he believed it demonstrated what was possible. Referring to Humphreys, he wrote:

> In this manufactory he has . . . established three points of great importance. One is that these manufactures can be carried on with success; another, that the workmen can be preserved in as good health as that enjoyed by any class of men in the country; and the third, that the deterioration of morals in such institutions, which is so often complained of, is not necessary, but incidental; not inherent in the institution itself, but the fault of the proprietor.[66]

Advocates of manufacturing claimed its introduction even initiated moral improvement by ameliorating the problems of an agrarian society unable to supply adequate employment. It would reduce poverty, as well as legitimize an alternative trade (after all, as Tench Coxe observed, there were many citizens "entirely unacquainted with rural affairs")[67] and provide employment for women, children and the infirm. Alexander Hamilton used the latter argument in his Report on Manufactures, because "this is the employment of persons who would otherwise be idle, and in many cases a burthen on the community."[68] The labor question was crucial, for work was thought to

be morally uplifting and here, apologists believed, was an opportunity to reduce the numbers of indigent, and hence strengthen the national hold on virtuous industry. Such ideas were even incorporated in the constitution of the Pennsylvania Society for the Encouragement of Manufactures and the Useful Arts, which proposed a "Manufacturing Fund" to finance the establishment of factories "for the better employment of the industrious poor, and in order to render the society as useful as possible."[69]

Manufacturers were so concerned with the moral and educational aspects of their workers' lives that even in the 1840s, Catharine Beecher complained they received so many improvements they had no time allotted to simple relaxation.[70] Yet worker discontent was minimal. The infancy of industry must assume responsibility here, as should the fluidity of society and the availability of land, but the attractive American interpretation of personal progress was easily applied to manufacturing, especially during a period of rapid growth. Labor believed in independence, democracy, republicanism and inevitable social mobility, for the myth decreed they too could become employers. As Marvin Fisher has rightly demonstrated in his analysis of the ramifications of Turner's frontier thesis, many Americans found their best opportunities in manufacturing, both as entrepreneurs taking advantage of the abundant resources and as workers improving their monetary status, and in America, pecuniary success was the best means of advancement.[71] The mill, the East, and manufacturing were as much a part of the American way as the farm, the West and agriculture. Labor in this early period generally held a positive image of manufacturing, for according to David Montgomery, "mechanics proudly preserved an ideological heritage blended of Ben Franklin's maxims and Tom Paine's 'rights of man.' "[72] Opposition to the new factories was strongest and most radical in those urban mid-Atlantic regions both in machine operating and machine breaking. According to the work of Cynthia Shelton, much early labor opposition can be traced directly to the influence of English and Irish urban immigrants, as opposed to a purely native response.[73]

The generally positive approach to manufacturing was complemented by varied lamentations on the degraded image of agriculture, not by recoiling into nature but by introducing science and technology, for according to the subtle Leonard E. Lathrop, "in Republican America, to labor in the field is unfashionable."[74] It was widely acknowledged that science and technology had greatly improved agricultural production. The connection was even offered as an inducement not to neglect the land, for it was well known that "our young men" possessed a "disposition to embrace other avocations, than those of husbandry," but a change of heart was assured "when it shall be known that a Lavoisier, a Chaptal and a Davy, have considered their talents best employed, when devoted to the cause of agriculture."[75] Agriculture needed to embrace technology to be progressive.

Agricultural societies, moreover, were supported not by stringent farming interests, but by men of diverse urban, commercial and political backgrounds who were simultaneously involved with promoting science and technology. The membership list of the Philadelphia Society for Promoting Agriculture contains names such as Federalist

lawyer and politician, Horace Binney; publisher and prominent advocate of manufacturing, Mathew Carey; banker Stephen Girard, who even bequeathed $300,000 to Pennsylvania for internal improvement; inventor and chemist Robert Hare; or William Keating, a minerologist who was not only a founder of the Philadelphia and Reading Railroad, but who also wrote *Consideration Upon the Art of Mining . . . And Advantages Which Would Result from or Introduction of this Art into the United States.*[76] Such a list suggests the spreading influence of those concerned with a diversified economy, civic duty, and a desire to reanimate agriculture with technology's energy. It was technology which would utilize the gifts of nature, regulate farm production, miraculously reduce price fluctuations, and give agriculture an economic and much needed social boost.[77]

Among those concerned for America's future, the positive acceptance of technology and especially the moves to promote native manufacturing form a clear statement of cultural nationalism. The steps towards a diversified economy, self-sufficiency and the support of nonagricultural labor indicates a growing economic maturity and a drive towards practical independence. To this end, advocates of manufacturing drew associations with the Revolution, with the local and international impact of the political experiment and pressed home a strong connection between economic prosperity, independence and national success. Similarly, technology was described in terms associated with positive American ideals. It signified progress; it represented liberation from the tyranny of arduous or time-consuming manual labor and it offered encouragement to genius. In technology could be found new ideas and exciting potential. Technology spread prosperity and opportunity. Most importantly, the rise of native manufacturing encouraged patriotism for it forced Americans to support local products, to reject the "luxury" of foreign imports and to cultivate the virtue found in personal and national industry. Technology represented more than visible inventions, gadgets, or machinery. It represented new energy and power, regularity, security and the defeat of natural caprice. The new technology was believed to represent the dynamism of the new American nation.

NOTES

1. John Randolph, quoted in William R. Bagnall, *The Textile Industries of the United States*, Vol. I, *1639-1810* (Cambridge: Eng., 1983), 154.

2. Jacob Bigelow, *Elements of Technology* (Boston: Willard, Gray, Little and Wilkins, 1829), v.

3. David J. Jeremy, *Transatlantic Industrial Revolution: The Diffusion of Textile Technologies Between Britain and America, 1790-1830's* (Oxford, Eng., 1981), 4.

4. Hugo A. Meier, "American Technology and the Nineteenth-Century World," *American Quarterly* 10 (Summer 1958): 116-30; idem, "Technology and Democracy, 1800-1860," *Mississippi Valley Historical Review* 43 (1957):618-40.

5. John F. Kasson, *Civilizing the Machine: Technology and Republican Values in America, 1776-1900* (Harmondsworth, Eng., 1977).

6. Brooke Hindle, *Technology in Early America* (Chapel Hill, 1966), 28.

7. Benjamin Rush, "Address to the People of the United States," *American Museum* 1 (February 1787): 11.

8. On the manufacture of war material see for example: Massachusetts (Colony) Provincial Congress, 1775. In Provincial Congress . . June 29, 1775, June 13, 1775 (Watertown, 1775), [Broadside]; *Resolutions of the Provincial Congress, of the Colony of New York for the Encouragement of Manufactories of Gun Powder, Musket Locks, and Salt* (New York: Jim Holt, 1776); specifically on the manufacture of firearms see also: Massachusetts Laws, Statutes etc., In Council, November 4, 1775 (Watertown, 1775), [Broadside].

9. "On American Manufactures," Letter II, *American Museum* 1 (Feb. 1787): 119. See also, *Address of the Philadelphia Society for the Promotion of National Industry, to the Citizens of the United States*, No. XII (Philadelphia: n.p., 1819), 5.

10. George S. White, *Memoir of Samuel Slater* (1836; New York, 1967), 199-200.

11. Ibid., 280-81.

12. *Connecticut Mirror* 4 Sept. 1809.

13. John Adams to Hezekia Niles, 13 Feb. 1818, in *The Works of John Adams*, d. Charles Francis Adams (Boston: Little, Brown and Co., 1856), 10: 283.

14. Zachariah Allen, *The Science of Mechanics* (Providence: Hutches & Carey, 1829), iii.

15. The work of Benjamin Smith Barton provides an example. The conclusion of his treatise on the rattlesnake was based on empirical studies which showed nature as economic and systematic. Benjamin Smith Barton, *A Memoir Concerning the Fascinating Faculty which has been ascribed to the Rattle-Snake and Other American Serpents* (Philadelphia: Sweitzer, 1796).

16. *American Museum* 1 (Feb. 1787): 117.

17. Thomas Jefferson, *Notes on the State of Virginia* (Philadelphia: Prichard & Hall, 1788), 175.

18. James Henretta, *The Evolution of American Society, 1700-1815* (Lexington, 1973), 175.

19. Mathew Carey, *Autobiographical Sketches* (Philadelphia: John Clarke, n.d.), 1: 42.

20. Tench Coxe, *A Statement of the Arts and Manufactures for the United States of America for the Year 1810* (Philadelphia: A. Corman, 1814), xx.

21. "Manufactures," *Niles Weekly Register* 12 (May 31, 1817): 222; White, *Memoir of Samuel Slater*, 108.

22. Kasson, *Civilizing the Machine*, 15.

23. *The New-Jersey Magazine and Monthly Advertiser* January 1787, 22.

24. Hugh Williamson, "Essay on the consequences of emitting paper-money; the necessity and advantages of encouraging American manufactures; the beneficial effects of an alteration in the present mode of taxation," *American Museum* 2 (Aug. 1787): 116.

25. *Address of the Philadelphia Society for the Promotion of National Industry, to the Citizens of the United States*, New Series. No. 11, Philadelphia, December 24, 1819 (Philadelphia: n.p., 1819), 4.

26. Ibid.

27. Benjamin Rush, "A Speech Delivered in Carpenter's Hall, March 16th, before Subscribers towards a Fund for establishing Manufactories of Woollen, Cotton, and Linen, in the City of Philadelphia," *Pennsylvania Evening Post* April 1775, 137.

28. *Address of the Philadelphia Society for the Promotion of National Industry, to the Citizens of the United States*, No. IX, June 3, 1819 (Philadelphia: n.p., 1819), 2.

29. *Address of the Philadelphia Society for the Promotion of National Industry* (Philadelphia: M. Carey and Son, 1819), preface, iii.

30. *The Plan of the Pennsylvania Society for the Encouragement of Manufactures and the Useful Arts* (Philadelphia: Aitken and Son, 1787), 3-4.

31. *An Act for laying a Duty on Goods, Wares and Merchandizes imported into the United States.* U.S. Cong. 1st Congress 1st Session 1789. Section 1.

32. *An Act to incorporate the Stockholders of the New-York Manufacturing Society 16 March 1790,* New York (State) Session Laws, 1789, *Laws of the State of New-York* (New-York: Childs & Swain, 1790), 3: 24; *An Act for the encouragement of a manufactory of Earthen Ware, by a loan of Money to the Proprietor thereof, 6 April, 1790,* ibid., 45; *An Act to incorporate the Contributors to the Society for establishing useful Manufactures, and for the further encouragement of the Said Society,* New Jersey Session Laws, 1791, *Acts of the Sixteenth General Assembly of the State of New Jersey*, First Sitting (Burlington: Isaac Neale, 1791), 730; North Carolina Session Laws, 1789, *Laws of North Carolina* (Edenton: Hodge & Wills, 1790), 36.

33. John Ruggles Cotting, *Report of a Geological and Agricultural Survey, of Burke and Richmond Counties, Georgia* (Augusta: Guieu and Thompson, 1836), 3-6.

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37. Jefferson, First Inaugural Address, 4 March 1801, *In The Writings of Thomas Jefferson*, ed. H. A. Washington (New York: J. C. Riker, 1856), 8: 4.

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40. Jefferson to Count Gysbert-Charles Van Hogendorp, 13 October 1785, *The Works of Thomas Jefferson*, ed. Paul Leicester Ford (New York: G. P. Putnam's Sons, 1904), 4: 469.

41. Jefferson to Benjamin Rush, 16 Jan. 1811, *Works*, 11: 168.

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43. Jefferson to Benjamin Austin, 9 Jan. 1816, *Works*, 11: 502-5.

44. Jefferson to M. Dupont de Nemours, 28 June 1809, *Writings*, 5: 457.

45. Hamilton, *The Federalist* (New York: J. and A. M'Leans, 1788) I, No. 6: 32.

46. Alexander Hamilton, *Report of the Secretary to the Treasury of the United States, on the Subject of Manufactures,* Presented to the House of Representatives December 5, 1791 (Philadelphia: Childs & Swain, 1791), 17.

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48. [Churchill Caldom Cambreleng], *An Examination of the New Tariff proposed by the Hon Henry Baldwin, A Representative in Congress* (New York: Gould and Banks, 1821), 9, 14.

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