

Industrializing Know-How:  
Technological Knowledge beyond the Exclusions of “Technology”

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In October of 1824, the managers of the newly formed Franklin Institute for the Promotion of Science and the Useful Arts held their first Annual Exhibition of Manufactures. Their purposes were lofty and patriotic. "By bringing together the various products of our workshops," they explained, "we shall soon discover what manufactures flourish in the country, -- what objects are successfully prepared by our mechanics,-- and in what respects they are deficient. Great as is the merit of new inventions, your board is convinced that to attain perfection of workmanship in old established inventions, is an object of at least as great importance. . . ."ii Indeed, items such as black broad cloth and marble mantles were to be encouraged alongside more newfangled stoves and cast iron pipes. At Annual Exhibitions throughout the decade, silver medals were awarded for products ranging from white lead to red earthenware, from iron ore made only with anthracite coal to silk spun only in Pennsylvania.

But the participants in the exhibition included several manufacturers unexpected amidst the "high tech" fanfare noted by most historians, and we would do well to consider why we dismiss them, and what we lose if we do. At the first Exhibition, the Pennsylvania Institution for the Deaf and Dumb was awarded two separate silver medals: one for a specimen of coarse cotton fabric called "Negro cloth," and one for a type of grass hat called a Leghorn bonnet. The Walnut Street School, run by the Philadelphia Society for the Establishment and Support of Charity Schools, submitted a straw bonnet, but the split straw hat made by children of the Fellenberg School "appeared the best of its kind." The committee also opined, in response to several bead purses and pieces of worked tapestry from the Roman Catholic Orphan asylum, that "these articles display much ingenuity and industry on the part of the infant artizans [sic], and deserve encouragement."<sup>iii</sup>

Recent work bringing the “linguistic turn” to the history of technology provides one explanation for why anthracite-forged iron might easily have been claimed as part of our purview while straw bonnets and Negro cloth have rarely been placed at center stage. If the word “technology” itself, as Leo Marx has argued, has functioned as a keyword for the 20<sup>th</sup> century, a marker of progress and complexity,<sup>iii</sup> then a history of that technology is likely to follow the paths most closely leading to the very systems warranting a new word in the vocabulary. But the keyword “technology” does not only exclude materials like cloth and straw: it also excludes all technologists – infant artizans and bonnetmakers -- not engaged in work leading inevitably to the large systems of the 20<sup>th</sup> century. If the process of construction of that keyword discursively excluded certain kinds of material activities and certain people as meaningful actors, those exclusions can easily frame our historical explorations.<sup>iv</sup> Yet definitions of “technology” offered within the SHOT community, especially by scholars working on periods and places outside the 20<sup>th</sup> c US, have long since been constructed broadly enough to encompass stone tools and guild

crafts, ancient waterworks and early mill design – the full range of human efforts to control their environment, or of “ways of making and doing things,” or of material manipulations generally.<sup>v</sup> Technology as analytical category has been developed deliberately to reopen the boundaries through which technology as keyword does its work of exclusion.

And yet, products of the 20<sup>th</sup> c as most of us still are, we routinely value analysis that emphasizes the large systems and the engineering elites of the keyword era; through our choices of topic we frequently reinscribe their belief in progress and even technocracy, despite our insistence on social constructions and non-technical influences.<sup>vi</sup> We struggle to include the actors the elites excluded, and to include the stories of roads not taken, failures, unsuccessful attempts, continuities rather than change. These recent discussions of the power of the keyword raise the possibility of needing a new term for the analytical exercise, to separate it from the connotations of the keyword “technology.” I shall call this new term X for the moment, and rename our august body the Society for the History of X. Possibly we could introduce X as a new popular term in discussions of globalization and continuing industrial change. Or (I think preferably) we might develop analytical tools to help us pursue the implications of our own definitions, definitions we have designed to work comparatively across time and cultures – we might contribute further to a shift in the popular meaning of “technology,” which meaning has, arguably, changed already in the 50 years we celebrate.<sup>vii</sup>

Joan Scott began her oft-referenced article “Gender: a Useful Category of Historical Analysis” with an admonition: “Those who would codify the meanings of words fight a losing battle, for words, like the ideas and things they are meant to signify, have a history.”<sup>viii</sup> In this piece she proceeds to introduce to historians a relatively new meaning for the word “gender,” once a strictly grammatical term and by the mid-1980s firmly borrowed by feminist theory to refer to socially constructed boundaries between people sexed male and female. Since then, of course, the term has become so ubiquitous that it can be found in common parlance substituting for sex, often without explicit recognition of its implicit contingency – and yet implying some whiff, however faint, of the possibility that biological sex might be insufficient as a delimiter of human experience.

For me, studying gender and race historically and considering the implications of gender theory such as Scott’s has illuminated and sometimes echoed problems in the history of technology, and not only because I find gender to be, indeed, a very useful category of analysis. Scholars who have puzzled, recently, over the English word “technology” itself – its uses, its origins, its popularity at particular moments -- situate the word firmly in the 20<sup>th</sup> century, with a few earlier invocations (and roots in other languages). Leo Marx, in writing about “technology” as a keyword of the 20<sup>th</sup> c US, has asked what the implications might be of applying historically a word not used by the historical actors we study. Eric Schatzberg, following the term through Thorsten Veblen’s work, laments the loss in English of a distinction between technics and technology found commonly in other languages, between knowing how and the study of the principles involved – a distinction possible only in certain areas of activity and only in the modern era. Scholars of gender history, and also race history and intersections of these social constructions of difference with other such categories (class, ability, age, etc), provide some assistance in refusing the exclusions of discursive hierarchies: just as they have interrogated the

boundaries of categories like “politics” and “religion,” so we can interrogate the potentially enormous terrain of X.

I suggest our strategy must be twofold. First, we do need to acknowledge “technology” as a keyword, and recognize not only the “semantic void” Leo Marx cites in explaining why older words no longer carry sufficient meaning, but also, as Ruth Oldenziel has argued, the exclusions, the social and cultural work accomplished by its creation. If “politics” is broader than suffrage, then people denied the vote can be political actors; if “religion” includes the laity as well as the clergy then idiosyncratic belief can be factored in to an understanding of religious agency. As Ruth Oldenziel, Rebecca Herzig, Rayvon Fouche and others have discussed – following in the footsteps of a long parade of people now SHOT’s elders -- creating the 20<sup>th</sup>-c understanding of technology and engineering inscribed a very particular kind of social and economic and cultural power, a power we need to recognize by studying its boundaries and exclusions as well as its center. As Arwen Mohun has argued about male owners of steam laundries, the exclusions and inclusions of these categories demand we attend to the dynamism and negotiation necessary to boundary maintenance.<sup>ix</sup> Gabrielle Hecht discusses the tendency in the US – in the very era of SHOT’s foundation -- to treat the technological as purely rational, devoid of dirty politics,<sup>x</sup> and in fact its whiteness and maleness and class associations also were successfully masked (or naturalized) by the creation. The keyword, in short, hides conflict. The semantic void may have come into being because of technological change, but it was simultaneously a discursive creation establishing new forms of social power, a category with boundary maintenance work to do.

The distinction Schatzberg highlights between knowing how and studying principles is also a discursive construction of boundaries, or different kinds of knowledge, a binary given to us by people in a particular position in a particular cultural configuration. Particularly if the distinction obtains “especially in engineering and industry” we must ask about what work it undertakes. Who studies principles and who “knows how”? How do we define the principles vs the knowing of how? Who draws the distinction, and to what ends? All of these questions need our attention historically and in the 21<sup>st</sup> century, as artisanal cultures collide with industrial ones, as technology (in the 20<sup>th</sup>-century keyword sense of the word) is transferred out of its original cultural context and questions of cultural influence, hegemony, and imposition travel with it., into places where material practices and meanings have been made indigenously for generations. Who now can claim knowledge of what?

The technology transfers of our own times only underscore the need for the second strategy. Whether we call it X or continue to speak of “technology,” we have more work to do in promoting the category of analysis, by which SHOT has sought to defy the stark tendency of our western and especially US culture to set technology in opposition to other realms of human endeavor. Most definitions offered by scholars in our field are intentionally broad, intentionally applicable to a range of historical contexts. They provoke a set of questions more than they invoke a set of things; as a category of analysis X is not an entity but a realm of human activity, comparable to religion or politics or economics. They defy, in short, many of the purposes of the keyword “technology” and aim to interrogate the very dangers of determinism Leo Marx has identified with the label. For the moment let us ride with the optimism of pairing “X and culture” as if their connections were worth exploring, and pursue the exposure of historical hidden boundaries by attending to the question of analysis.

Leo Marx identifies the danger of determinism when “technology” is made subject and actor in descriptions of human history. He also wonders at the practice of using a word to describe historical contexts that the historical actors themselves would never have used. Separating very deliberately the analytical category X from the 20<sup>th</sup> and 21<sup>st</sup> century meanings of technology is an answer to the latter concern as well as, potentially, an assault on the former – as scholars we always bring our own context to the dialogue with the past. The art and craft of writing history demands we recognize, as best we can, how our view of the world differs from that of our sources. The danger comes when we bring our assumptions with us unrecognized: when, for example, we work backwards from the keyword, uninterrogated, and so focus on the encouragement of mining, the publication of patents, the testing of steam boilers -- ignoring the straw bonnets and the “negro cloth,” with their links to recommendations for what poor women should do at home, and to the northern role in supplying the American slave economy. We also ignore their emphasis on “perfection of workmanship” with its recognition of the artisan’s role in the production economy of early industrial capitalism – indeed the creation of “progress.”<sup>xi</sup>

Joan Scott recommended, back in 1986, that historians attend to the interconnected but analytically distinguishable layers in which gender difference operates (she intended her approach to apply to other axes of social difference as well). She recommended attention not only to individual gender identity, but also to the gendered social structures and institutions by which genders are sorted, and to the (often conflicting) symbols and representations a society draws on to reproduce, maintain, or negotiate the boundaries of gendered expectations and operations of power.<sup>xiii</sup> The analytical category X, too, operates on multiple levels in a society. I invite the theorists among us to refine my rough suggestion here, but at the very least we can and do examine the artifacts themselves, how they work, what is needed to make them accomplish some purpose; the institutions and social structures that organize them and the access to the material thing, to knowledge about its workings, to the benefits and other effects of its workings; and the symbolic meanings and representations – sometimes contradictory, certainly changing over time – people attach to the things and systems around them. Our work lies in exploring the connections and influences between these layers, all of which are part of the large category X. The assumptions of popular culture often treat these connections and influences as monodirectional, from artifact to social and cultural effect, but we know the relationship is more complicated. We have been saying so for years. The challenge, however, of finding the interconnections with layered elements of social difference, most obviously gender and race or ethnicity, but not only those, continues. The rationality of technology as keyword denies their existence.

The Franklin Institute, sponsor of the 1824 exhibition including items from coal to bonnets, was only one of many institutions established in the 19<sup>th</sup> century US for the purpose of organizing and structuring change in X and the nature of at least some people’s Xical activity. In my own work, I have found such institutions to be rich sites of exploration of the ways Americans navigated the long process we call industrialization – such institutions bear tight connections both to the physical layer of X (coal, iron, paint, bonnets, beadwork) and to the symbolic meanings of calling orphans “infant artizans” or stressing the importance of “workmanship” alongside “invention.” The difficulty, of course, is to maintain the analytical stance: if X is ways

of making and doing things, or ways people seek to manipulate the environment, then weaving dried straw into a bonnet is as worthy of note as puddling iron to make a pipe. If we sputter at the comparison because we at first see only difference, we need to attend to the ways straw bonnets and iron pipes have been organized institutionally and structurally, and the ways people of the 1820s in Philadelphia and of our own times have given meaning to straw and to iron, to headwear and to plumbing.

Words always take their meaning in context. Even were we to decide to rename our category X, that category will be a product of this moment in our thinking. Were it to speak to some more popular need for a new label, it could become the next keyword, with all the baggage of the moment; if not, it would remain another bit of arcane academic label-seeking. But in any case, we in SHOT are a collection of people who have stressed the importance of the material and of lived experience as well as of language – of physical referents, the material contents of categories, the ways of being and acting in the world that rely on knowledge that is not linguistic.<sup>xiii</sup> In any time and place of dramatic change in the ways people interacted with their environments, in the ways they made and did things, the categories and the words are quite likely to shift, not always in precise alignment with the material changes, but certainly in relation to the meanings of material change. For the remainder of the present discussion, I will drop X and return to technology – as analytical category, including cloth and cooking as well as rotors and riveting.

In the 19<sup>th</sup> century transformation of industrial capitalism in the US, words and categories were in flux, a potentially confusing soup of allusion and meaning best considered associatively, like neural networks, rather than linearly, like genealogy. The “useful arts” of the early Franklin Institute was sometimes “mechanic arts,” and in turn “mechanic” was sometimes a synonym for “artisan,” but increasingly referred to the machine. It was deployed as an identity of pride among the true producers of the early Republic, and as a disdainful dismissal of the undereducated by elites at mid-century.<sup>xiv</sup> As “science” became a label to appropriate we find it describing a wide range of activities, from “domestic science” to “scientific management”; later in the century we also find “industrial arts” evoking industry as opposed to idleness, or more frequently industry as mode of production, as gainful employment, as sphere of capital accumulation or wage work.<sup>xv</sup>

By the end of the century in the US, institutional and structural segregation of material and social categories was congealing in ways familiar to the 20<sup>th</sup> century, and demonstrable at the grand displays of the age: at the 1876 US Centennial in Philadelphia and the 1893 Columbian Exposition in Chicago there were separate Women’s Buildings – the Centennial one came complete with “lady engineer”<sup>xvi</sup> running the steam engine; the Columbian Expo excluded African Americans entirely, with the exceptions of a pavilion for Haiti, a hired cook performing as “Aunt Jemima” at the R.T. Davis pancake mix booth, and a bevy of porters and waiters. At the Cotton States and International Exposition in Atlanta in 1895, grand display of the economic possibilities of what some promoters liked to call the New South, “Negroes” were allowed a separate building to display their own progress. And in a public relations move echoing for decades in the history of race in the US, that most materialist of black leaders, Booker T. Washington, was invited to walk a discursive tightrope, addressing the role of “his race” in an imagined future south, segregated but industrial.<sup>xvii</sup> Such fairs and expositions are symbolic and performative affairs as well as institutional ones, reflecting some combination of conscious and

unexamined decisions and attitudes on the part of committees and supporters, and may or may not reflect lived experience, or widespread belief. They remind us nonetheless that race and gender boundaries were natural and ever-present to the elites who built American progress and American technological systems. They need not be as natural to scholars.

This institutional and structural access layer provides a middle ground for exploring the connections between the material content of the category “technology” and the symbolic and representational meanings, the tight social and political connotations, we have also been working to explore. Identifying the borders and boundaries and then working across them – tracking insiders and outsiders, male and female, free and slave, engineering and craftwork – forces us to examine them critically, to look for constructions and negotiations of categories of power. This methodology is the legacy of gender and race analysis taken together with the labor history of the late 20<sup>th</sup> century: our view of any one side of these boundaries is impoverished if we do not interrogate the boundary itself. The examples that follow below move across several borders to examine children as well as adults, and the city’s least respected rather than its elites. Attending to our analytical categories and to the historical actors’ structural ones helps us chart the interweavings of social and technological ideologies and practices at the center of industrialization.

Educational institutions, in general, offer evidence of how grown-ups plan the future for children, their own or other people’s. School boards and institution managers imagined productive futures for their charges, quite often including some form of what might often be called “skill,” but in keeping with the analytical mission I have outlined here, I will label “technological knowledge.” Technological knowledge allows a person to participate in some kind of making and doing, in some kind of manipulation of the material environment. Sewing, blacksmithing, cooking, drafting, chair caning, carpentry, and textile printing are all activities relying on technological knowledge.

Where the exhibitions and expos mustered and regimented artifacts and technological knowledge in the service of the symbolic, the schools’ purposes were conceived in the more practical and budget-constrained terms of how to prepare children for productive lives, for an appropriate economic and social position in the imagined city of their adulthood. Often these locations are sites of demarcation and boundary, of explicit articulation of power and hierarchy. The Franklin Institute managers designed programs based on what ambitious young male craft apprentices might need; at the other end of the institutional gamut, the managers of the House of Refuge considered what forms of knowledge might transform “juvenile delinquents” into productive citizens. Within a few years the Franklin Institute’s leaders were focusing on a drafting school and steam engines rather than straw bonnets or even the attendance of ladies at their lecture series; at the House of Refuge, the quest to conquer idleness and thus vice provides the historian with an extended discussion of how middle and upper class managers understood how technological knowledge functioned in the labor economy of their day for different categories of children.

Like many other institutions of the era, the Philadelphia House of Refuge was designed to provide opportunity to a particular group of young people. Where the Franklin Institute invited apprentices to its lecture series and then ran a high school aimed at the sons of its members, most

of the youths in the Refuge would otherwise have lived on the streets, in the almshouse, or in prison. Believing that potentially innocent children were falling under the worst influences of a rapidly growing city, a group of elite Philadelphia philanthropists organized the House of Refuge in 1826. The managers aimed to create an environment in which potential future criminals would become instead productive and upstanding citizens.<sup>xviii</sup> Exploring technical education at this remove from science and engineering, from clear forbears of the keyword “technology,” provides an alternative perspective on the relationships between social power and technological knowledge.

The "inhabitants" of the House of Refuge were committed on charges ranging from larceny to vagrancy. The commitment process was not spelled out in the annual reports; managers and potential donors evidently knew who belonged. Although it was a private institution, the mayor, courts, and some lesser officials were able to commit children to the House. Troublesome youths from the Almshouse -- such as those who had been bound out as apprentices and had had problems with their masters -- were transferred to the Refuge. Several other inmates were transferred from one of the local prisons. The majority of inmates were male, but a quarter to a third were female; most were teenagers, many of whom had served some time as apprentices -- one was found to be sufficiently knowledgeable of bookkeeping that the Visiting Committee suggested he could help with the House accounts. A majority of inmates had lost one or both parents; the largest proportion were missing fathers, rendering the family economy unstable.<sup>xix</sup>

The legal frameworks of state guardianship of poor children meant that children could be committed to the care of the Refuge until they reached the age of majority, age 18 for girls, and 21 for boys. The managers planned to bind their charges out, as did the city's Guardians of the Poor, once they were likely to be useful as apprentices -- in this case "after a due degree of discipline has been administered, and instruction received."<sup>xx</sup> During their highly structured waking hours, they would learn at least the rudiments of literacy, and they would work at some employment.

Education and employment were fundamental to the establishment of moral rectitude. As the managers put it,

Idleness is the parent of vice. The mind no less than material nature abhors a vacuw [sic]. If not furnished with useful reflections, it will dwell upon those which are pernicious. Hence the House of Refuge will be a place of never ceasing occupation, to every inhabitant.<sup>xxi</sup>

But the purpose of the "manual labor" was not solely the prevention of idleness. The managers intended that the employment would "be varied with the capacity and disposition of the individual," and proclaimed that "knowledge of some trade will be acquired, which among the youth who usually enter prisons is a rare attainment." Morality and practicality were not, of course, unrelated: to the managers, acquiring the knowledge of a trade meant a boy had "the means of gaining an honest livelihood."<sup>xxii</sup>

The Refuge opened in 1828 in brand new buildings whose structure offers us a moment of reflection on the ideologies and technologies of social control in this period. Gender and room function ordered the architecture. The main building consisted of a central section flanked by symmetrical wings -- one side for girls, one for boys. The dining rooms and chapel, housed in

the middle section, were also constructed to keep the sexes "from conversation and even from seeing each other."<sup>xxiii</sup> The wings contained schoolrooms and sleeping chambers -- each seven feet by four feet, including only a bedstead and shelf, "but well lighted and ventilated, and exposed at all times to absolute superintendence and inspection."<sup>xxiv</sup> The door to each room was provided with a lock, on the outside.

With only two exceptions, all of the youths sent to the House of Refuge in the early years were white. Several decades later, race would be addressed explicitly by the managers – they constructed two adjacent new Refuges, one Colored and one White, with girls' and boys' quarters in each.<sup>xxv</sup> In the 1820s, however, exclusion seemed the best plan; as the Visiting Committee wrote:

The Mayor committed to the Refuge a coloured boy who was brought into the house this afternoon, the Committee thinking it not prudent to receive him request[ed] the Constable to take him back to Arch St. prison which he accordingly complied with.<sup>xxvi</sup>

But the following year, the issue was raised again. The Visiting Committee noted that a boy was left at the Refuge by the Sherriff of Chester County, and again questioned the placement: "The said Elias being a Mulatto -- the point is reserved, whether he is to remain at the Refuge or not." Evidently he remained -- the Superintendent noted the same day that "Eli H[.] 13 years of age was this day rec'd committed by the Court of the Quarter Sessions of Chester County on the charge of Larceny. He is a coloured boy & the first inmate of that kind in the house."<sup>xxvii</sup>

Surviving evidence hints that young Eli did not have an easy time in his new home. He was found hiding; he was blamed first for transgressions later laid to other boys. In one instance "a trunk was broken open in the house" and the Superintendent's wife suspected Eli, because he had been scrubbing the stairs that day.<sup>xxviii</sup> These incidents suggest that Eli was not treated as just another one of the boys; most importantly for our purposes, I found no other references to boys being put to household chores such as scrubbing stairs.<sup>xxix</sup> The presence of a mulatto child invited transgression of technological gender boundaries.

The white boys' days mixed a traditional apprenticeship model, in which a child acquires knowledge while assisting with the tasks of the workshop or household, with a rigid scheduling by the clock unusual in the 1820s artisanal workplace.<sup>xxx</sup> The annual report for 1829 told its readers that the boys were engaged in bookbinding, basketmaking, wicker-works, shoemaking, tailoring, and carpenters' work. The girls performed sewing, washing, ironing, mending, cooking, and general housework. By 1830 the managers could proclaim that all the clothing worn by the pupils was made within the House, and could provide some impressive statistics to their supporters. In the year from May 1829 to May 1830, fewer than 80 boys had, among other accomplishments, made some 1030 pairs of shoes and some 10,000 wicker covers for demijohns of different sizes, sewn more than 750 pantaloons or jackets, and bound over 100,000 spelling books. Thirty girls, meanwhile, had sewn 390 sheets, 292 shirts, 198 frocks and assorted bed ticks, underwear, and night caps. They also bound uppers for 92 pairs of shoes (presumably completed by the boys), and marked 228 pairs of stockings. (Marking, a staple of household management in households wealthy enough to have multiple textile items, meant simple embroidery for inventory tracking: the stockings probably bore initials or names or numbers in cross-stitch.) The managers did not count how many dishes the girls had washed, garments they

had laundered (although they would do so in later decades), beds they had aired, meals they had helped prepare, or square feet of floor they had cleaned.<sup>xxxix</sup>

The eight hours of work each day in fact seem to have functioned conveniently for the managers, providing both a laudable learning experience for the inmates and also, in the case of the boys, a source of income for the institution. The girls performed most of the housekeeping, but their contribution was never assigned a monetary value, though paying a laundress or seamstress for these services would have made them economically visible. The managers did announce the income from the boys' work in the annual reports, but were quick to assure readers that the sum (12.5 cents per boy per day of work) was "altogether inadequate to the discharge of the share of the expense" for each child. In fact, children were rarely kept at the House if they were capable of earning their own keep on the outside:

The object is to prepare the children to earn their own livelihood, and as soon as they are sufficiently instructed to become valuable apprentices to any particular trade, to bind them out, and let their labour be available at first to their masters, and afterwards to themselves.<sup>xxxix</sup>

Nonetheless, in the year from 1830-31, the House of Refuge collected \$1798.99. While this sum would hardly keep the institution running, neither was it an insubstantial contribution.

Generally, the managers' rhetoric focused on the educational and instructional value of the work performed by the inhabitants of the House of Refuge, rather than the economics of their captive workforce. But local artisans took the technological activity at the Refuge seriously, and apparently complained of being underbid on work. In response, the managers downplayed the boys' knowledge:

it is apprehended, that no encroachment is made upon the rights of others. The work done by the boys is necessarily short of perfection. It is designed as an exercise, as a means of instruction. When any degree of proficiency is acquired, they are in a condition to become apprentices, and the earliest opportunity is embraced to bind them out. While undergoing these preparatory trials, which are rather useful to themselves than the employers, it cannot be expected, that they will rival even the most indifferent of those who labour for wages in the regular workshops of the city. The price charged is of course proportioned to the skill displayed.<sup>xxxix</sup>

A journeyman in this period was indeed likely to make at least 5 times as much in a day's work.<sup>xxxix</sup> So when the boys in the shoemaker's shop made 100 pairs of shoes on the order of the Almshouse,<sup>xxxix</sup> we can see why the local artisans might have been concerned.

Manual labor had multiple functions: education for the future, occupation to prevent idleness, and profit for the institution. While the managers maintained publically that the work was of more use to the boys than the employers, the surviving log books suggest that the boys' labor could indeed be valuable to the craftsmen brought in to teach them, if the boys stayed long enough. At one point, when the boys temporarily outnumbered available jobs, the basketmaker agreed to take up to fifty more inmates, "on condition, that they are not discharged as soon as they have become acquainted with the business -- so that he may calculate upon their services at least a year."<sup>xxxix</sup> The boys were acquiring some amount of technological knowledge in their industrious hours.

Finding the right work for the boys was tricky enough that at several points there were job shortages within the House of Refuge. At such times even older boys ended up with simple tasks like picking oakum, which apparently did not suit the managers' purposes. But the boys did not suit all artisans, either, as when the Visiting Committee "regret[ed] to find that the person who undertook to employ part of the boys in weaving cotton webbing has not found it answer [sic] his expectations thus accordingly removed his machinery."<sup>xxxvii</sup> Similarly, a child could be too young for profitable work. When Charles B., aged about eight years, arrived among the first group of inhabitants, the committee assigned him to the basket maker's shop. The basket maker, however, told the superintendent that he had nothing the boy could do. The superintendent recorded "I have accordingly agreed with the Bookbinder, that he shall employ him whenever he has any thing which he can do, without any compensation untill the comt. direct otherwise."<sup>xxxviii</sup> Apparently the bookbinder was a patient man; nearly six months passed before the Superintendent recorded that "Mr. Kimber wishes to be relieved of any further trial of Charles B[.] in the Book-bindery as he considers him rather a nuisance than otherwise."<sup>xxxix</sup> The tasks of the workshops were not simply busywork to prevent idleness.

The managers' vision of adulthood was personalized: at least in the early days the managers hoped each boy would be able to perform work that suited him. Usually if a boy had previous experience, it dictated his assignment, but in several cases a boy was reassigned because he was disinclined toward a particular kind of work. One had spent 4 years as a shoemaker, suggesting he might be useful in the shoemaker's shop -- "but," the committee noted, "he says the trade doth not agree with him."<sup>xl</sup> Another, assigned to the carpenter's shop, showed little disposition for the work. The visiting committee found that he preferred shoemaking, and consented to that assignment.<sup>xli</sup> Another boy "who did not promise to make an expert Carpenter" was "transferred to the Bookbinder."<sup>xlii</sup>

But this concern with the boys' choice of future trades proved difficult to maintain. Ideally, the successful boy at the Refuge would acquire a rudimentary education and workshop-based craft knowledge, and go out into the world as a respectable artisan. The successful girl would get married, having acquired the knowledge needed to run her own household. Providing this training to the girls seemed obvious to the managers, although housework for a working-class family likely differed in certain basic ways from housework in a large institution. Providing artisanal training to boys proved more complex, both within and beyond the institution. Only in some cases did technological knowledge of the kind provided at the Refuge lead to an imagined social mobility. During the year 1829-30, 55 children were apprenticed, including 10 girls apprenticed to housewifery. Of the 45 boys, 16 were indentured to farmers, 10 to whaling voyages, 9 to screwmaking, 2 to papermaking, 2 to cloth manufacture, and 1 each to a miller, a shoemaker, a tailor, a tobacconist, a merchant, and a carpenter.<sup>xliii</sup> Obviously these boys had practiced neither farming nor whaling at the Refuge -- but both occupations were traditional placements for pauper apprentices. In practice, work was more important than developing expertise.

And morality sometimes rivalled workshop business, evident when outside workers in the Refuge caused trouble. In several instances the offending worker left, but in other cases these outside workers were sufficiently important to the craftsmen who taught the boys that

compromises were found. In the spring of 1829, for example, the basket maker's wicker workers were stripping willows at the Refuge. The boys became noisier in the yard, because of the "presence and free conduct" of the men; a few days later some of the boys told the superintendent that the men had used "profane language" cursing one of the boys. The Visiting Committee first directed that the boys should work in the other shops and that the workers should leave promptly.<sup>xliv</sup> But the basket maker "represented to the visiting committee that a serious loss would occur from the order of the visiting committee to discharge during this day the men employed by him in stripping the willows & begged that their continuance might be permitted until Saturday next, when all difficulties should be removed." In the meantime the boys were not to be allowed to visit the yard "under any pretext" while the workers were there.<sup>xlv</sup>

The managers' understandings, then, of the moral values of artisanal work sometimes clashed with the experience of shop floor values. There are other signs in the record of the perpetuation, despite the managers' efforts, of traditional artisanal values: one boy hid his tools repeatedly to avoid work,<sup>xlvi</sup> suggesting that tool possession and ability to work were closely linked to him. The superintendent inquired of the Visiting Committee early on whether there was an agreement about the number of hours the shoemaker and tailor should work each day, suggesting a discrepancy in opinions.<sup>xlvii</sup> There were also signs that the managers had little experience with the realities of workshop life, providing us with illustrations of emerging middle class values: when the managers visited the wicker workshop, for example, they became "sensible of a heavy and disagreeable Odour which it was apprehended was occasioned by the water used for soaking the willows." The water, they learned, was changed three times each week. Finding "that sickness is rather promoted by the present condition of this Room," they believed the water should be changed daily -- and ordered a drain built into the floor so the trough could be emptied more easily.<sup>xlviii</sup>

The boys' work at the House of Refuge reflected the inconsistencies of the managers' ideas about Philadelphia's mechanic class, a group with whom they had little regular contact. The managers' possibly nostalgic vision of workshop-based craft production as an antidote to vice meant that the boys were working with "genuine" artisans (albeit carefully selected ones) who brought their own ideas about work. The managers hoped that white boys would acquire artisanal knowledge without adopting artisanal values, and then somehow join the artisanal community. Also the knowledge the boys acquired was incomplete, as for example none of the boys participated in the stripping of willows. Such limited knowledge and division of labor evokes factory rather than workshop production methods, and in many ways the managers sought to instill factory discipline rather than workshop emulation. The girls, meanwhile, were engaged in what appeared to be housework, albeit on a much larger scale, which came complete with material values -- like marking socks -- unlikely to be manifest in a worker household. We should also recall that of the two racialized boys in the record from these years, one was sent back to adult prison and the other apprenticed to a farmer in a slave state from age 14 or 15 to age 21. Along with the gender and race clarity in these sources, class issues show up here as a contested boundary.

Which boundaries are contested and which easy to draw vary with context. In the case of the House of Refuge, the 1850s addition of a Colored House of Refuge carefully segregated from the white Refuge gave way in the 1890s to a new plan, as both the white and colored boys' departments moved from their urban quarters to new accommodations outside the city. The girls

stayed behind in the existing facilities in Philadelphia. Instead of separate Colored and White Departments, further divided into girls' and boys' departments, after the move the fundamental structural division within the Refuge was by gender instead of by race. The sources blur old distinctions as well: although the new boys' school provided separate colored and white "cottages," racial distinctions were no longer made in the annual reports. Photographs of the female department, at least, show fully integrated workrooms. Whether there were racialized divisions of labor on the boys' campus is very hard to judge.

There were new ideas about morality and work at the new site, where a working farm supplemented the boys' workshop occupations. In fundraising efforts during more than a decade, the managers dwelt on boys' morals but emphasized that "agriculture and horticulture" could be added to the trades (such as chair caning and brush making) already taught, and they had plans for a new shop building.<sup>xlix</sup> By 1888, when the new buildings were underway, the managers had made a study of "leading reform schools" in America and Europe, and were confident that the new setting would "secure... the most improved and modern reformatory methods" available.<sup>1</sup> Citing international discourse, work remained at the center of the discussion.

Before the move, House of Refuge inmates had been spending their days working, as in the 1820s, with school in the early morning and evening hours. Officially, the managers sought to provide "the kind of work... which they can follow as an occupation when they are thrown upon their own resources." But, citing the difficulties of finding work that could be performed by children aged seven to sixteen who spent an average of only about fifteen months in the institution, in 1882 manager Thomas Robinson made clear the demise of the artisanal model:

Owing to these difficulties, the managers are obliged to provide such occupations as can be obtained whereby they may be kept employed during their hours of labor, and educated practically into habits of industry, and at the same time have them taught, as far as possible, the rudimental branches of different trades and occupations, which will, if the boy or girl is ambitious and determined to get on in the world, be a great aid in enabling them to procure employment in the branches of industry with which they have become partially acquainted in the House of Refuge.<sup>li</sup>

At the end of the century, "habits of industry" generally won out over training in viable "branches of industry": most of the boys worked at brush-making, wicker work, tailoring, making toy watches, and chair caning, none of them in the most promising sectors of the Philadelphia manufacturing economy. Another 50 or so boys were "employed in the grounds around the Home and in-door work, keeping the dormitories in order, and all kinds of work where their services can be useful to themselves and useful to the Institution."<sup>lii</sup>

For all of the girls, sewing was still the primary trade practiced at the Refuge. As Robinson explained, "they do all the plain sewing for every Department of the House," beginning by sewing carpet rags, and moving on through sheets and towels until they could eventually "make their own dresses." (Managers did not generally discuss the boys' tailoring in this context, despite the topic of producing clothing.) Robinson also noted that girls were "taught all kinds of house-work, washing and ironing, and some few plain cooking."<sup>liiii</sup> He did not choose to point out that besides being "taught" washing and ironing, the girls performed all of it for the more than

500 inmates of the House, by hand. But girls' work had never been discussed in terms of educational value.

Despite the similarity of description, the household work in the white Refuge had undergone a fundamental reorganization since mid-century. With the 25 white boys in the tailor's shop making all the white boys' uniforms for wear within the House, as well as their "citizen's" clothes -- coat, pants, and vest for each boy at discharge -- the sewing load of the white girls had decreased dramatically. Accordingly, more than half of the white girls in 1880 -- 53 -- were employed in one of two hosiery shops (the other employed 60 white boys). In this shop, as Robinson described it, white girls were "employed at machine stocking knitting." The Refuge had acquired small factory operations.

The girls in the colored department continued to perform the tailoring for the colored boys. Girls' needlework, accordingly, varied by race. By 1880, when stockings knitted and number of shoes fitted are excluded from the accounting of white girls' work, the quantities of sewing each girl performed had begun to diverge. They diverged even further by 1890, when the list of items sewn by the white girls did not include the 400 pounds of carpet rags or several hundred items of officers' bedding which they had sewn in 1880. Effectively, white girls were getting a more focused sewing curriculum, supplemented by machine tending. The quantity of laundry, on the other hand -- which the managers began counting at the end of the decade, perhaps because it was so formidable -- maintained the traditional patterns of mid-century housework: it varied with the number of people wearing clothes, without regard for the number of people washing them (by hand).<sup>liv</sup> The managers did not record whether they assigned more boys to the tailor's shop as the male inmate population grew, but probably they did: more boys to clothe were also more boys to train.

In describing the inmates' work in 1882, Thomas Robinson wove together the threads of trades training and juvenile caretaking. He several times stressed that ambitious boys -- and girl stocking-knitters -- could pursue the trades begun in the Refuge once they were free; he also explained how each shop had a Prefect assigned to it, whose job was to see both "that the boys are diligent in their work, and that no advantage is taken of them by those in whose service they are laboring." His closing remarks, however, summed up the topic of labor far more simply:

I have thus tried to give, in as condensed a form as I could, the manner in which the Managers of the House of Refuge seek to perform this important branch of their work, namely, *the forming of industrial habits* in the children committed to their charge.<sup>lv</sup>

As in other institutional programs directed at children identified as potential laboring-class workers in this period, "industrial habits" ultimately deserved the most attention.<sup>lvi</sup>

The Refuge was, however, still an institution granted guardianship of its charges, with power to bind them out or discharge them at the discretion of the managers. By the 1880s, apprenticeship was no longer a requisite step on the path to productive adulthood; terms like "industrial school" claimed that schools had become places where children learned the practices of industry. When manager Benjamin Smith described the indenturing system in 1882, he made no mention at all of the trades children might be learning. Instead, he stressed the provision of "good homes where they will have the opportunity of growing into respectable men and women." Children should be

placed "far away from the vicious and corrupting influences" of their childhoods, which were implicitly urban:

the experience of many years has confirmed the opinion that our wards can be exposed to no more wholesome influences, physically, as well as mentally, than are to be found in the homes of the clear-headed and warm-hearted farmers living in the country which lies around Philadelphia, on both sides of the Delaware river, and within a radius of some fifty miles.<sup>lvii</sup>

Smith also explained, in a discussion about "children" that pertained largely to boys, the terms of the exchange: the "consideration" for the child's "service" until he or she turned 18 was "a good home," food, clothing, two months' schooling each year, and small amounts of cash paid into the keeping of the Refuge each year until the child reached majority. In the final year, the farmer got a 17-year-old helper for \$20 plus bed and board, a bargain indeed for an increasingly experienced farm hand.<sup>lviii</sup> In this discussion "indenturing" had lost its educational connotations. Fewer and fewer boys were being indentured when they left the Refuge: only about a quarter were bound out in 1890.<sup>lix</sup> The practice was seldom called "apprenticeship," and being indentured to a farmer was unlikely to lead to ownership of a farm anyway. The practice was construed in the rhetoric of institutional publications only as a moral good, not as a means of learning a trade.

But by the 1890s, technical education among educators and managers was coming more and more to be viewed as a school-based phenomenon, and when managers discussed the boys' move they explained the nature of the technical education that might be provided in the new facilities. They reported that they hoped to teach "mechanical trades, such as carpentry, blacksmithing, masonry, painting, printing, and other useful branches" in the large new shop building. In setting forth their intentions, they offered a new interpretation of the options available to boys leaving the Refuge:

No department of reformatory training is of equal importance to this education. The difficulty of obtaining suitable employment for the boys when they leave the institution increases year by year. Agricultural pursuits offer but little inducement, and too often are distasteful to a boy when at liberty to return to his family and friends as a wage earner. The drudgery of the store or factory offers small remuneration, but with a trade he has a reliance always at hand for comfortable support.<sup>lx</sup>

By the early 1890s, the managers had come to prefer a "trades school" to an "industrial school" – educators in many institutions were appropriating trades as the province of schools, and the content of the technical education at the Refuge reacquired an importance, at least rhetorically, reminiscent of that accorded the workshops during the first few years. In a trades school boys would acquire specific technological knowledge in addition to the old "habits of industry," and be set on a path to a suitable adulthood by way of such training.

There is no discussion of how young people outside the Refuge might learn such trades, or how tradesmen viewed the new plan. This set of managers evoked a different understanding of the labor market than the members of Philadelphia's Board of Public Education, who ran an elementary school in an immigrant neighborhood on the explicit assumption that its students would not go to high school, but would be taking on factory work by age 14. At the Forten School, technological knowledge was justified quite explicitly in terms not only of neatness and

accuracy but also of honesty and obedience. The Refuge managers dismissed factory work when discussing careers but instilled these qualities in other ways: in 1892, the managers discussed “efforts being made to improve the drill of the pupils in marching when passing from one place to another or assembling for public exercises.” Each cottage had “the instruction of its own officer, who can employ a short time at frequent intervals for drill.”<sup>lxi</sup> We have no record like the detailed log books of the early years to tell us how managers and administrators discussed the boys’ work in practice rather than in public reports. We can only guess from such discussions that the shop floor control still asserted by craft workers in a range of trades would not have found favor with the Refuge managers had it manifest among the boys.

Meanwhile, the departure of the boys had a dramatic effect on the responsibilities and work of the girls and matron in the Girls' Department back in Philadelphia, as the Superintendent noted in her first annual report:

The recent removal of the Boys' Department to Glen Mills... has, we trust, resulted profitably to the girls. The labor in the laundry for more than six hundred persons, done entirely by hand, has, in consequence of this removal, been diminished, giving us more time for thorough instruction in all our departments of labor.

When the boys moved, the average number of items washed annually by each girl dropped to less than half of previous levels. The extra time was used profitably: the girls' Department now employed "a professional dressmaker to instruct the girls in this very necessary and useful branch of education," and the baking activities formerly performed by boys had been transferred, as well. The Superintendent called bread-baking "one of the most useful branches of housekeeping," and reported that "all the bread consumed by the family [of about 150 persons] is now made by the girls."<sup>lxii</sup> Cooking classes continued, possibly for both colored and white inmates. And, while the text of the reports do not mention the change, accounting reports indicate that some of the girls worked at caning chairs.<sup>lxiii</sup> It remains unclear who inherited the boys’ laundry, and with what mechanical help.

Annual Reports at the House of Refuge do not mention concern over the employment of the girls. Girls had an obvious trade by definition; girls did housework, and poor girls did housework in other people's houses. House of Refuge girls were experienced at sewing, bread-baking, laundry, and cooking, and were evidently not hard to place under indenture. As opposed to the boys, whose indenture rates had fallen below one in seven in 1892, more than half of white girls and more than two-thirds of colored girls were indentured on discharge from the Refuge.<sup>lxiv</sup> A teenaged girl indentured from the House of Refuge was a servant, and a bargain. Not surprisingly, when managers discussed trades training for inmates, they were concerned with boys -- once the girls could spend their energies on cooking, baking, and dressmaking as well as housekeeping and laundry, they were being exposed to the full range of knowledge the managers thought they might need.

But in turn the programs at the House of Refuge must be situated among other kinds of technical education. On one hand, at Philadelphia’s Manual Training High Schools where shop training was combined with science and math education and the senior class project might be to design and build a dynamo, the principal explicitly stated that the purpose of the program was “not to make mechanics, but to prepare boys for manhood” – he rejected the label of the trades school.

On the other, when the Institute for Colored Youth, an academic high school once known for teaching Latin and employing a highly educated African American faculty, was moved to a farm school in the country, the new campus had neither printing press nor electricity, though it claimed to offer “industrial” education as part of a teacher training program. The delinquents at the House of Refuge had both. Hierarchies of technical education mapped unevenly but deliberately onto the social order of the turn of the century, and vocabularies adjusted accordingly.

Examining a range of such programs, it becomes clear that each institution limited or enhanced access to particular kinds of technological knowledge. Some children were taught to copy patterns, others to invent them; some were taught to run machines, others to build them. Those responsible for institutional decisions made available to each group of students only portions of a hierarchy of technological knowledge, sometimes with absolute authority, and sometimes in constant negotiation with the constituencies they served. The more privileged reaches of these hierarchies are most familiar in the history of technology we know best: the rhetoric of professional engineering is riddled with references to design, to precision, to the importance of paper-based abstract representations of knowledge. These values were just emerging at the Franklin Institute of the 1820s, and were well in evidence by the end of the century – but not at the House of Refuge, not in public schools for immigrants or private ones training black teachers to teach black students in the rural south, and not in most of the technical education provided to females. If we look carefully, however, the technological contents of “unskilled” work was not devoid of technological knowledge – of knowing how to make and do things, to manipulate the material environment to achieve some particular purpose -- in the later part of the century any more than it was at the Franklin Institute’s First Exhibition. Rather, these technologies were structurally, discursively, and representationally rendered distinct from other forms of material activity. Exploring the 19<sup>th</sup> century with attention to both sides of dynamic boundaries, we can see the arena of the keyword emerging – and we can document the exclusions.

This process raises questions for us as historians and as citizens of a globalizing economy. As historians we know the context is specific; context matters. Industrialization in the US has been both comparable to and different from industrialization in other places. Most obviously, as Amy Dru Stanley has noted, “only in the US did full-scale industrial capitalism develop simultaneously with, and literally alongside, the consolidation and overthrow of chattel slavery.”<sup>lxv</sup> How do we study other contexts without imposing the meanings of these very particular congealings of culture and social power?<sup>lxvi</sup> It seems to me that we can get closer by framing analysis in ways that help us see dynamic exclusions and negotiations, and help us understand the work such boundaries are intended to accomplish. Deliberate analysis helps us avoid reinscribing contingent boundaries our actors defined as absolute.

This approach offers general lessons, too, because even today in industrializing settings technological changes of production are not imagined without reference to workers, and the reorganization of work at the center of industrialization means a reorganization of social roles and social power. In a period of technological change, this power is tightly tied to technological knowledge and access to particular kinds of knowledge. What structures shape access to

engineering education? To knowledge of electrical generators or indigenous crafts? Whose knowledge is paid for and whose under- or unremunerated? Who claims the labels and keywords of power?

Our analysis will of course be limited. We can only define our categories in our own terms, in conversation with our sources. Ours are no more some set of ideal platonic categories than were the keywords of mid-century. But the lessons from gender history and race history ask us always to look across any boundary, to see who is not allowed in -- and ask why not.

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\* This paper has been immeasurably improved through conversation with and readings by Arwen Mohun, Gabrielle Hecht, Lynn Sharp, and Mats Fridlund. I have tried to indicate my many other intellectual debts to SHOT members in the notes.

<sup>i</sup>Franklin Institute, First Annual Report (Philadelphia: 1825), hereafter cited as FI-AR1(1825), First Quarterly Report, p. 37.

<sup>ii</sup>Report of Exhibition, FI-AR1(1825), pp.65-6; *Franklin Journal and American Mechanics' Magazine* 1(1826):2-5; 2(1826):264; hereafter cited as *Franklin Journal*.

<sup>iii</sup> Leo's article here

<sup>iv</sup> Leo Marx article; Ruth and Eric in T&C 2006; Francesca Bray book on gender and tech.

<sup>v</sup> Ruth Cowan in Social Hist of Am Tech; get footnote from osiris piece

<sup>vi</sup> Leo again

<sup>vii</sup> at least in US english. A perusal of, say, the NYT "technology" section will leave one contemplating sound systems and personal computers more than the electrical grid....? see also Schatzberg, n 6.

<sup>viii</sup> Joan Wallach Scott, "Gender: A Useful Category of Historical Analysis," *The American Historical Review*, Vol. 91, No. 5. (Dec., 1986), pp. 1053-1075.

Stable URL: [http://links.jstor.org/sici?sici=0002-](http://links.jstor.org/sici?sici=0002-8762%28198612%2991%3A5%3C1053%3AGAUCOH%3E2.0.CO%3B2-Z)

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<sup>ix</sup> Oldenziel, recent T&C and book; Herzig, shot paper; Fouche, old shot paper and book; Mohun article and book; see Gender and Tech reader for historiographical discussion of the work of Ruth Schwartz Cowan, Joan Rothschild, Martha Moore Trescott, Autumn Stanley, Carroll Pursell, Judith McGaw and others.. The argument about the cultural work of boundary maintenance and the power constructed by naturalizing such boundaries is widespread in more recent histories of white supremacist segregation in the US as well as in gender histories.

<sup>x</sup> Hecht, *Radiance of France*, last ch, find pages

<sup>xi</sup> See Robert Gordon, "Who Turned the Mechanical Ideal..." T&C labor issue 1988?

<sup>xii</sup> I oversimplify. For the full explication see Scott, pp. 1067-69. [notes in case I need any of them: "gender is a constitutive element of social relationships based on perceived differences between the sexes, and gender is a primary way of signifying relationships of power." p. 1067. Scott identifies four elements: "culturally available symbols that evoke multiple (and often contradictory) representations"; "normative concepts that set forth the meanings of these symbols... written as if these normative positions were the product of social consensus rather than of conflict"; "a notion of politics as well as reference to social institutions and organizations" – not only kinship but labor market, education, polity; "subjective identity" historically situated. Sandra Harding analyzes three elements. [get cit]

<sup>xiii</sup> Hindle, *Emulation and Invention*; Ferguson, *Mind's Eye*; Vincenti book; Layton Tech as Knowl; Borg -- ?

<sup>xiv</sup> Roediger, Wages; Stott? Wilentz? mfg promoter bk? Leo Marx is perhaps too limited in his treatment...

<sup>xv</sup> on science see my osiris piece, also histories of home ec (that essay collection?); on “habits of industry” see (what? T&C article and its citations?)

<sup>xvi</sup> find cit, in “not mech”

<sup>xvii</sup> on 1893 see Rydell, Nye, Bederman, [someone else on porters?], Manring on Jemima; on BTW and Atlanta see “Cotton States and International Exposition to be Held in Atlanta...” New York Times, June 8, 1895; Lerman, “New South, New North,” Richardson, *Death of Reconstruction*, Gilmore, *Gender and Jim Crow*.

<sup>xviii</sup> House of Refuge, “Address to the Citizens...” (1826), p. 12 (hereafter HR-Ad'26). For details on the reformatory aspects of the institution, see Mary Glazier, “The Origins of Juvenile Justice Policy in Pennsylvania” (Ph.D. Diss., University of Pennsylvania, 1985).

<sup>xix</sup> By May of 1929, the Refuge housed 57 boys and 23 girls. HR AR'29 p 7; by mid-June there were 77 boys and 25 girls. HR-B-1 6/20/29. In December the superintendent surveyed the inhabitants and found that “of the 117 now in the house 41 have lost their fathers, 19 their mothers, and 27 are orphans. This leaves only 30 whose parents are both living; many of whom are worse than none being intemperate and careless.” See also HR-B-1 12/8/29; 12/10/29.

<sup>xx</sup> HR Ad'26. p. 11. At night each inmate slept alone; this philosophy of solitary reflection was also implemented at Philadelphia's Eastern State Penitentiary.

<sup>xxi</sup> HR Ad'26. p. 9

<sup>xxii</sup> HR Ad'26, p. 10.

<sup>xxiii</sup> House of Refuge, *Annual Report* [for 1829], p. 5, hereafter AR'year.

<sup>xxiv</sup> HR AR'29, pp. 4-5.

<sup>xxv</sup> See Lerman, “Preparation for the Duties...” T&C 1997.

<sup>xxvi</sup> House of Refuge, Minutes of Visiting Committee (HR-A201), 12/30/28. See note 72 on the irregularity of the language in this document. [???

<sup>xxvii</sup> HR-A201 11/10/29; HR-B-1 11/10/29. Emphasis in original.

<sup>xxviii</sup> HR-B-1 11/20,21/29; HR-A201 11/21/29.

<sup>xxix</sup> Negley Teeters, “The Early Days of the Philadelphia House of Refuge,” *Pennsylvania History* (1960):165-187, p. 179. Eli was bound out in April of 1831 to a Maryland farmer. See also Lerman, disst chapter.

<sup>xxx</sup> HR AR'29. Worship and schooling took place before the 7:00am breakfast and after the 5:00pm supper. A lesson or lecture on a “useful, moral, or scientific subject” was paired with dinner from noon until 1:00pm. Children were locked into their rooms from 8pm to 5am. For a useful account of artisanal time and the reorganization of technological knowledge and tasks, see Merritt Roe Smith, *Harper's Ferry Armory...*; Herbert Gutman and other labor historians have documented similar patterns elsewhere.

<sup>xxxi</sup> HR AR'30 p. 28 On May 1, 1829, there were 57 boys and 23 girls; on May 1, 1830 there were 80 boys and 30 girls. Turnover was far higher than those numbers suggest; during that same year 111 boys were received, 30 were discharged, 12 escaped, 1 died, and 45 were bound out. On the girls' side, 29 were received, 12 discharged, and 10 bound out.

Table 1. Boys' Production, 1829-30

items	product
1030	shoes of different kinds
250	jackets

521	pantaloons
4153	wicker covers for 1 gallon demijohns
3149	wicker covers for 2 gallon demijohns
2862	wicker covers for 1/2 gallon demijohns
1143	wicker covers for pint flasks
558	willow baskets
110,969	bound spelling books

Table 2. Girls' Production, 1829-30

items	product
44	bed ticks
11	pillow ticks
160	pillow cases
6	bed quilts
390	sheets
65	towels
2	boys jackets
292	shirts
25	flannel shirts
31	chemises
40	petticoats
282	aprons
72	capes
76	corsetts
198	frocks
234	pocket handkerchiefs
27	night caps
92	bound uppers, pairs of shoes
228	marked pairs of stockings

<sup>xxxii</sup>HR AR'29 p. 8

<sup>xxxiii</sup>HR AR'30 p. 13; see also HR-B-1 12/2/29.

<sup>xxxiv</sup>See Boydston, *Home and Work* pp. 61-62.

<sup>xxxv</sup>HR-B-1; HR-A201 11/3/29.

<sup>xxxvi</sup>HR-A201 11/3/29

<sup>xxxvii</sup>HR-A201 10/28/29; see also HR-B-1 8/27/29, HR-A201 9/11/29, HR-A201 9/25/29.

“Picking oakum” is untwisting the fibers of old ropes, which were then used for caulking. See Oxford English Dictionary online, draft 2004 entry, at

[http://dictionary.oed.com/cgi/entry/00328877?single=1&query\\_type=word&queryword=oakum](http://dictionary.oed.com/cgi/entry/00328877?single=1&query_type=word&queryword=oakum)

<sup>xxxviii</sup>HR-B-1 1/12/29; Case Histories (HR-C-1).

<sup>xxxix</sup>HR-B-1 6/27/29. On young boys see also HR-A201 6/29/29, HR-A201 4/18/29

<sup>xl</sup>HR-A201 9/18/29; HR-B-1 3/17/29; HR-A201 11/3/29.

<sup>xli</sup>HR-B-1 1/7/29; HR-A201 1/10/29.

<sup>xlii</sup>HR-B-1 3/17/29; HR-A201(?) 3/18/29.

<sup>xliii</sup>HR AR'30, pp. 28-9.

<sup>xliv</sup>HR-B-1 4/22,30/29, 5/2/29; HR-A201 5/12/29; HR-A201 5/19/29.

<sup>xlv</sup>HR-A201 5/19/29 afternoon.

<sup>xlvi</sup>HR-B-1 3/12,19/29.

<sup>xlvii</sup>HR-B-1 2/13/29; the Committee reported that they had agreed to work 11 hours/day until April, at which point they would work 12. HR-A201, 2/14/29.

<sup>xlviii</sup>HR-A201 9/15,22/29

<sup>xlix</sup>HR-AR80, p. 8.

<sup>l</sup>HR-AR88, pp. 8-9.

<sup>li</sup>"Thomas A. Robinson on the Employment of the Children in the House of Refuge," reprinted in HR-AR82, p. 76.

<sup>lii</sup>Robinson, p. 78. At the time of Robinson's report, which was part of a presentation made to the Philadelphia Society for Organizing Charity in 1882, 220 boys worked in the brush shops, 40 in the wicker shop, 35 in the caning shop, and 25 in the tailor shop. Three also worked in the bakery, three in the boiler room, and two in the shoe shop, all performing, with the tailors, work on behalf of the Refuge. The tailor shop and the shoe shop were located on the white side; the tailor shop did not sew clothing for the colored boys. In 1880, colored boys worked in the watch shop, the wicker shop, and the brush shop. Colored girls did the colored boys' tailoring. White boys worked in the brush, hosiery, caning, shoe, and tailor shops, the bakery, the engineer's department. 16 were listed working in "kitchen and halls" and 1 in the lodge, with 12 "unemployed." HR-AR80, p. 22. Watchmaking was gone by 1882, in which case the remaining 35 or so kids working indoors etc. were probably colored. Shoes were made on the colored side by about 15 boys in 1860, and on the white side by only a few boys in 1880. HR-AR60, p. 10. The white girls fitted 310 pairs of shoes in 1880, but shoe fitting was not typically recorded.

<sup>liii</sup>Robinson, pp. 77-78.

<sup>liv</sup>House of Refuge, Girls' Work, 1854, 1880, 1890

	1854 white	1854 colored	1880 white	1880 colored	1890 white	1890 colored
avg number girls	47	36	80	41	106	49
avg number boys	194	75	252	137	442	133
ratio boys/girl	4.1	2.1	3.2	3.3	4.2	2.7
items sewn	5630	2161	4212	2830	3281	1837
sewing/girl	119.8	60.0	52.7	69.0	31.0	37.5
sewing/boy	29.0	28.8	16.7	20.7	7.4	13.8
pieces washed					694,981	240,300
laundry/girl (hundreds)					65.6	49.0
laundry/boy (hundreds)					15.7	18.1

Data calculated from HR-AR54, HR-AR80, pp. 23, 30; HR-AR90, pp. 24-25.

<sup>lv</sup>Robinson, p. 79. Emphasis mine.

<sup>lvi</sup>see Lerman, "Uses of Useful Knowledge" Osiris 1997.

<sup>lvii</sup>"Mr. Benjamin R. Smith on Indenturing," reprinted in HR-AR82, pp. 80-81. This policy is noticeably different from the approach of New York City reformers like Charles Loring Brace, who sent droves of children to mid-western guardians. See Robert M. Mennel, *Thorns and Thistles: Juvenile Delinquents in the United States, 1825-1940* (Hanover, NH: University Press of New Hampshire, 1973), Chapter 2.

<sup>lviii</sup>Smith, pp. 81-82. The possibility of collecting money at the end of the term of indenture may well have provided some incentive not to run away, but given that the managers viewed running away as proof "in most cases, that the child was unfit to leave the House," and that if a runaway was caught "for his own sake he is returned to [the House of Refuge] and continued for a second or third term," hinterland farm work may have been worth choosing.

<sup>lix</sup>The proportion of those discharged by indenture dropped off significantly during the decade. In 1880, 85.7% of colored girls, just under half of all boys (48.9% of white boys, 47.5% of colored), and 39.0% of white girls had been indentured after their stay in the Refuge. By 1890, the proportion of boys indentured had fallen below that of white girls, with 22.0% of white boys and 28.4% of colored boys bound out. The proportion of white girls had dropped to 31.4%; and the proportion of colored girls was almost as low at 35.5%. In 1880 79.8% of white boys were indentured to farmers; the remainder were indentured to 16 other trades. No trades were specified for indentured colored boys. In 1890, 88.9% of white boys and 65.2% of colored boys were indentured to farmers; the number of other trades was down to 5 for white boys, and was 7 for colored boys. HR-AR80, HR-AR90.

<sup>lx</sup>HR-AR92, p. 14.

<sup>lxi</sup>HR-AR92, p.32. Photographs from the 1890s show boys in uniforms marching in orderly formation into or out of the schoolhouse and other buildings. On the Forten School see Lerman, "The Uses of Useful Knowledge."

<sup>lxii</sup>HR-AR92, p. 49.

<sup>lxiii</sup>HR-AR92, pp. 42, 51.

House of Refuge, Girls' Work, 1890 and 1892

	1890	1892
	white + colored	girls' dept.
average number girls	155	135
average number boys	575	549
ratio boys/girl	3.7	4.1
items sewn	5118	5898
sewing/girl	33.0	43.7
sewing/boy	8.9	10.7
pieces washed	935,281	346,876
laundry/girl (hundreds)	60.3	25.7
laundry/boy (hundreds)	16.3	6.3

Data calculated from HR-AR90, pp. 24-25 (see table above); HR-AR92, pp. 50-51. In addition to the work reported above, the girls mended more than 20,000 pieces of clothing that year. HR-AR92, pp. 50-51. See also Lerman, "Not to Make Mechanics" (unpublished ms.).

<sup>lxiv</sup>HR-AR92, pp. 19, 47. The report for the boys' department does not differentiate by race.

<sup>lxv</sup>Amy Dru Stanley, *From Bondage to Contract* p. 60.

<sup>lxvi</sup>the image of technology as "congealed culture" is David Noble's. I have been influenced at various points by his *America By Design* and *Forces of Production*. I have also been influenced over the years by sociologies of technology and knowledge, including [schoolbus, Latour, others], and by feminist philosophy of science [Longino, Harding]. The discussion here leads obviously to consideration of various formulations of hybridity, which must be left beyond the scope of this paper – I have chosen here to use craft metaphors (entwining, weaving, embedding) rather than biological ones to discuss interconnected categories of analysis. In general I find them more conducive to exploration of human agency.