12-2012

The Body Machinic: Technology, Labor, and Mechanized Bodies in Victorian Culture

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ABSTRACT

While recent scholarship focuses on the fluidity or dissolution of the boundary between body and machine, "The Body Machinic" historicizes the emergence of the categories of "human" and "mechanical" labor. Beginning with nineteenth-century debates about the mechanized labor process, these categories became defined in opposition to each other, providing the ideological foundation for a dichotomy that continues to structure thinking about our relation to technology. These perspectives are polarized into technophobic fears of dehumanization and machines "taking over," or technological determinist celebrations of new technologies as improvements to human life, offering the tempting promise of maximizing human efficiency. "The Body Machinic" argues that both sides to this dichotomy function to mask the ways the apparent body-machine relation is always the product of human social relations that become embedded in the technologies of the labor process.

Chapter 1 identifies the emergence of this dichotomy in the 1830s "Factory Question" debates: while critics of the factory system described workers as tools appended to monstrous, living machines, apologists claimed large-scale industrial machinery relieved human toil by replicating the laboring body in structure and function. Chapters 2 examines factory workers' autobiographies which record their experiences of being treated like machine parts, disposed of when broken by gruesome factory accidents. Chapter 3 analyzes Trollope's *Michael Armstrong* and Tonna's *Helen Fleetwood*, in which merely occupying the space of the factory initiates workers' transformations into a dangerously politicized yet mindless "community of automata." Chapter 4 analyzes Babbage's mathematical theory, his Difference Engine, and Dickens's representation of

Babbage in *Little Dorrit* to argue that representations of mechanization were crucial to debates about the category of mental labor, which we continue to define as productive of intellectual property through its categorical opposition to mechanized manual labor. The conclusion looks at Butler's *Erewhon* and argues that the particular forms of technophobia and technophilia that dominate today—in which humans become increasingly mechanical, or machines become increasingly life-like—are a direct inheritance of Victorian constructions of human and mechanical as categorically opposed, and of the resulting metaphor of the mechanized laboring body.

THE BODY MACHINIC: TECHNOLOGY, LABOR, AND MECHANIZED BODIES IN VICTORIAN CULTURE

by

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Dissertation
Submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy in English.

Syracuse University
December 2012

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Introduction

"Do you think I am an automaton? a machine without feelings? and can bear to have my morsel of bread snatched from my lips, and my drop of living water dashed from my cup? Do you think, because I am poor, obscure, plain, and little, I am soulless and heartless? You think wrong—I have as much soul as you,—and full as much heart" (215-16).

Charlotte Brontë, *Jane Eyre*, 1847

"The machinery of all my nature, the whole enginery of this human mill: the boiler which I take to be the heart, is fit to burst" (497).

Charlotte Brontë, *Shirley*, 1849

In Jane's angry outburst at Rochester, she accuses him of treating her like an "automaton," a mere mechanical simulation of a human being. This kind of comparison between a person and a machine can be traced back through the history of automata, and it functions by extrapolating from the automaton a label for a person who acts, as Jane explains, "soulless and heartless," like "a machine without feelings."[1] In the passage from *Shirley*, Robert Moore's description of his impassioned change of heart employs a different category of metaphor in likening the body to a factory that operates through the cooperation of its various mechanisms, all linked and powered by a steam engine "heart." The cultural lineage for this second kind of metaphor includes the Cartesian view of a

[1] See Wendy Beth Hyman's thorough analysis of the *OED*'s multiple definitions for "automaton" (5-6).

clockwork universe in which the body was similarly mechanical in the cooperation of its many internal moving parts.[2] As seen in the example from *Shirley*, with the rise of steam power in the nineteenth century this metaphor of a mechanical body came to incorporate the images and technologies of the new industrial factory.

Both of these kinds of metaphors assume some existing basis of comparison between bodies and machines: either that people can seem mechanical in their personalities, feelings, and actions, or that living bodies can seem mechanical in the structure and function of their internal parts and processes. This dissertation looks beyond these two versions of the mechanical body by identifying a third category of metaphor that emerged in early-nineteenth-century British literary and cultural responses to industrialization. Instead of assuming a fundamental similarity between bodies and machines, critics of the burgeoning "Factory System" objected to the ways factory labor forced the machine's mechanical movements onto the worker's body, and based their argument upon a categorical opposition between human and mechanical labors. Caroline Norton's anti-industry poem "A Voice from the Factories" (1836), for example, describes the mechanization of a small child laboring alongside the machine in an industrial factory:

> There the pale Orphan, whose unequal strength
> Loathes the incessant toil it *must* pursue,
> Pines for the cool sweet evening's twilight length,

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[2] See David F. Channell's *The Vital Machine* for an overview of the development of the mechanical worldview of a clockwork universe and mechanical organisms in the seventeenth, eighteenth, and nineteenth centuries. The Cartesian view of living things as mechanical remained compelling throughout the nineteenth century, as evidenced T. H. Huxley's revision of the Cartesian mechanist philosophy in "On the Hypothesis That Animals Are Automata, and Its History" (*Fortnightly Review*, 1874).

> The sunny play-hour, and the morning's dew:
> Worn with its cheerless life's monotonous hue.
> Bowed down, and faint, and stupefied it stands;
> Each half-seen object reeling in its view—
> While its hot, trembling, languid little hands
> Mechanically heed the Task-master's commands. (XLVI)

Norton's assumption of a categorical opposition between body and machine is highly typical, characterizing the machine's labor as "incessant" and "monotonous" and contrasting this "mechanical" labor against the child's inherent desire to move in time with the rhythms of nature along a schedule of "morning's dew," "play-time," and "twilight." Heedless of the child's "unequal strength," the machine—Norton's "Task-master"—forces its mechanical speed, rhythm, and motions onto the child's body. Nineteenth-century cultural responses to industrialization generally came to rely on this categorical opposition between an idealized, natural, human labor and the mechanical movements forced onto factory workers, resulting in the emergence of this third kind of metaphor of mechanized body and the proliferation of this new image of laboring bodies turning into machines. As in Norton's poem, through laboring *with* the machine, the factory worker is forced to labor *like* a machine—incessantly, monotonously, "Mechanically"—and thus the child who "*must* pursue" this mechanical labor becomes mechanized, transforming from an "Orphan" to an "it."

This opposition between the labor of the machine as precise, tireless, incessant, and monotonous and human labor as having more "natural" rhythms, movements, and speeds has gone unidentified because it has not yet been disentangled and differentiated

from other kinds of metaphors of mechanical bodies. This particular type of mechanized body based in the opposition between human and mechanical labor in fact became pervasive in Victorian literature and culture beyond scenes of industrialization. John Ruskin's chapter "On the Nature of the Gothic" in *Stones of Venice*, for example, defines human labor as involving inventiveness and mental faculties, as opposed to the repetitive, monotonous, and mindless use of the body which he labels merely mechanical labor. "Understand this clearly," Ruskin writes:

> You can teach a man to draw a straight line, and to cut one; to strike a curved line, and to carve it; and to copy and carve any number of given lines or forms, with admirable speed and perfect precision; and you find his work perfect of its kind: but if you ask him to think about any of those forms, to consider if he cannot find any better in his own head, he stops; his execution becomes hesitating; he thinks, and ten to one he thinks wrong; ten to one he makes a mistake in the first touch he gives to his work as a thinking being. But you have made a man of him for all that. He was only a machine before, an animated tool. And observe, you are put to stern choice in this matter. You must either make a tool of the creature, or a man of him. You cannot make both. Men were not intended to work with the accuracy of tools, to be precise and perfect in all their actions. If you will have that precision out of them, and make their fingers measure degrees like cog-wheels, and their arms strike curves like compasses, you must unhumanize them. All the energy of their spirits must be given to make cogs and compasses of themselves. (160-61)

Ruskin does not simply make a distinction between mental and manual labor, but bases his critique on an opposition between human and mechanical labor. He aligns innovation, variableness, and even imperfection with human labor which is "healthy and ennobling" (165), while categorizing labor as "mechanical" when it is not only mindless but done with "admirable speed and perfect precision," which he claims are features of a distinctly mechanical labor for which "men were not intended" (161). While responses to industrial factories describe factory workers as mechanized when the machine forces its monotonous, precise, and repetitive speeds and motions onto the body, Ruskin claims *any* worker becomes mechanized when the task at hand requires "unhumanizing" mechanical labor which simultaneously shuts down the possibility to work like a "man."

In identifying and analyzing this third category of metaphorically mechanized bodies, this dissertation aims to historicize the emergence of the very categories of "human" labor and "mechanical" labor as ideas, in addition to historicizing the idea of mechanization itself, which is usually taken for granted in discussions of early industrial labor. Images of mechanized workers and the oppositional categories of human labor and mechanical labor initially emerged in the "Factory Question" debates of the 1830s.[3] In their efforts to seek specific reforms to the working and living conditions of factory workers, social critics like James Philips Kay (later Sir James Philips Kay-Shuttleworth) blamed the faults of the new factory system on the newly mechanized labor process

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[3] Throughout the dissertation I rely especially on the following histories of British industrialization: Raphael Samuel's "Workshop of the World: Steam Power and Hand Technology in Mid-Victorian Britain" (*History Workshop Journal*, 1977), Clark Nardinelli's *Child Labour and the Industrial Revolution* (1990), Maxine Berg's *The Age of Manufactures: Industry, Innovation, and Work in Britain, 1700-1820* (1994), Robert Gray's *The Factory Question and Industrial England, 1830-1860* (1996), Katherine Honeyman's *Child Workers in England, 1780-1820: Parish Apprentices and the Making of the Early Industrial Labour Force* (2007), and Jane Humphries's *Childhood and Child Labour in the British Industrial Revolution* (2010).

which required workers to move at the same speed as the machine, to follow its arithmetically precise rhythms, and to reshape their bodies to the demands of the machine's movements. These critics represented the mechanization of the labor process and the physical impact on workers through images of dominating machinery that comes to life in its monstrous control of the worker, whose body transforms into a machine through the inhuman demands of factory labor. Pro-industry apologists for the factory system like Andrew Ure quickly responded by claiming that the machinery in fact relieves workers of the most tedious, repetitive, and hence "mechanical" aspects of the labor process. In response to the critics' descriptions of children's bodies disfigured by the demands of machinery, apologists depicted children frolicking alongside the machine with abundant energy, and created images of the entire factory in which workers and machinery joined together as organs in a harmonious, healthy body. While each side to this debate produced oppositional characterizations of the relation between the laboring body and the machine—it either mechanized the body or freed it from distinctly mechanical labors—both sides idealized the supposedly natural rhythms of "human" labor defined through its categorical opposition to the distinctly "mechanical" labors of the machine.

Critics and supporters of the factory system thus produced alternate representations of a "body-machine" relation. The mechanized labor process that both sides to this debate sought to represent in fact involved spatial and technological innovations that newly enabled the capitalist to have greater control over the speeds, times, and movements of the labor process through direct control over the worker's body. Rather than accept the existence of either of these versions of the body-machine relation,

however, this dissertation argues that both versions of the "body-machine relation" function as mystifications of the material social relation between worker and capitalist. This social relation becomes embedded in the technologies of the labor process, thus resulting in the images of an alternately monstrous or harmonious machine. Throughout the project I employ a historical materialist approach that enables me to prioritize the fact—which becomes clear in the analysis of this imagery—that the technologies of the labor process and the laboring body itself are both sites of class struggle.[4] I analyze a range of representations of mechanized laborers at various sites in Victorian literature and culture, and by foregrounding the centrality of class struggle to the production of these images I aim to shift the scholarly conversation about the apparent "body-machine" relation.

I examine cultural responses to the factory system, including reform literature, working-class autobiographies, Parliamentary reports and evidence, and industrial fiction, and I contextualize descriptions of mechanical bodies and monstrous, life-like machinery in the technological and spatial changes to the early industrial labor process. My project therefore provides an inaugural account of the historical emergence of these images by placing them in direct relation to the history of industrial technology. One of the most frequently cited texts on the topic of the nineteenth-century laboring body is Anson Rabinbach's *The Human Motor: Energy, Fatigue, and the Origins of Modernity* (1990).[5]

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[4] I have found extremely helpful the following discussions of Marx's theories and of Marxist historical materialism: David Harvey's *The Limits to Capital* (1982) and *Spaces of Hope* (2000), Neil Smith's *Uneven Development: Nature, Capital, and the Production of Space* (1984), Ellen Meiksins Wood's recuperation of E. P. Thomson in *Democracy against Capitalism: Renewing Historical Materialism* (1995), Rosemary Hennessy's *Profit and Pleasure* (2000), and Terry Eagleton's *Why Marx Was Right* (2012).

[5] Rabinbach describes the arrival and ascendancy of a new view of the laboring body as a "the human motor." He argues that this image arose as a direct result of Hermann von Helmholtz's mid-century

Despite the fact that Rabinbach is primarily concerned to identify "the human motor" in European (mostly French and German) scientific investigations into the resistance to fatigue (beginning in the 1870s) and the sciences of motion (beginning in the 1890s), many literary scholars have been eager to identify the image of the "human motor" in British and American culture as far back as the 1830s—before the advent of these sciences of work and before the discovery of the thermodynamic principles which Rabinbach credits with inspiring the new productivist view of work.[6] Joseph Bizup's *Manufacturing Culture: Vindications of Early Victorian Industry* (2003), for example, conducts a thorough examination of early-nineteenth-century pro-industry texts, but argues that these writers were participating in the view of the body that according to Rabinbach would only emerge decades later in the European sciences of work (20).[7]

In seeking a methodology that would enable me to historicize cultural representations of the labor process, I have relied heavily on Marxist labor process theory, particularly the strand that began interrogating the early industrial period

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discoveries in thermodynamics which triggered a large-scale shift across Europe toward the productivist model of work—"the belief that human society and nature are linked by the primacy and identity of all productive activity, whether of labourers, of machines, or of natural forces" (3).

[6] Ted Underwood has advanced an important critique of the applicability of Rabinbach's work to Victorian views of labor by countering Rabinbach's assumption that "thermodynamic science gave rise to new theories of work" and arguing instead that "Victorian writers perceived the 'circulation of force' as a peculiarly important discovery in large part because it seemed to ratify this existing productivist interpretation of work" (123). While Underwood's clarification of the ideological roots of Victorian productivism is extremely important, particularly to examinations of nineteenth-century British energy sciences, the misidentification of Rabinbach's "human motor" in Victorian culture still requires clarification.

[7] Several scholars of nineteenth-century American culture have similarly applied Rabinbach's argument to American industrialism, seeing the pre-conditions for Fordism and Taylorism throughout the nineteenth-century. Mark Seltzer's *Bodies and Machines* (1992) couples Rabinbach's "human motor" with Foucault's "body-machine complex" which he identifies in turn-of-the-century American naturalist fiction, focusing on "couplings" between bodies and machines and the "'vague and shifting' line between the animate and the inanimate' and between the natural and the unnatural" (3). See also Donald M. Lowe's *The Body in Late-Capitalist USA* (1995), Ruth Oldenziel's *Making Technology Masculine: Men, Women and Modern Machines in America, 1870-1945* (1999), Carolyn Thomas de la Peña's *The Body Electric: How Strange Machines Built the Modern America* (2003), and Stephen P. Rice's *Minding the Machine: Languages of Class in Early Industrial America* (2004).

following the publication of Stephen Marglin's "What Do Bosses Do? The Origins and Functions of Hierarchy in Capitalist Production" (1974) and Harry Braverman's *Labor and Monopoly Capital* (1974). Unlike traditional views of the period produced by economic historians, historians of the labor process see labor as a combination of tools, machinery, skills, work practices, and organization. Instead of assuming technological change as the sole motor of historical change, labor process historians aim to examine the connections between technical change, workplace organization, management, skilling and deskilling of the workforce, and control over the pace and practices of labor, and to analyze these changes in relation to the various interests at stake in their implementation.[8] I have also been influenced by related work in the philosophy of technology, which has further helped me to think outside of technological deterministic narratives and enabled me to critique ideologies of efficiency, progress, and technological superiority in my primary texts.[9] I have found especially helpful Andrew Feenberg's incorporation of the Frankfurt School into philosophy of technology and his development of methods of identifying the "ideological basis of technology" (7). His work has enabled me to connect the methodologies of literary analysis which draw from Marxist historical materialism

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[8] In addition to the overview to labor process theory provided by the edited collection *Rethinking the Labor Process* (1999), I have found the following historical studies especially helpful: Michael Burawoy's *Manufacturing Consent: Changes in the Labor Process under Monopoly Capital* (1979), David F. Noble's "Social Choice in Machine Design: The Case of Automatically Controlled Machine Tools, and a Challenge for Labor" (*Politics and Society*, 1978), and William Lazonick's *Competitive Advantage on the Shop Floor* (1990).

[9] In developing my understanding of the philosophy of technology I have relied particularly on Langdon Winner's *Autonomous Technology: Technics-Out-of-Control as a Theme in Political Thought* (1977), *Donald A. MacKenzie's Knowing Machines: Essays on Technical Change (1996), Andrew Feenberg's Questioning Technology (1999) and Transforming Technology: A Critical Theory Revisited (2002), as well as several anthologies and critical introductions to the field, including A Companion to the Philosophy of Technology* (edited by Jan Kyrre Berg Olsen, Stig Andur Pedersen, and Vincent F. Hendricks, 2009), *Readings in the Philosophy of Technology* (edited by David M. Kaplan, 2009), and *Philosophy of Technology: The Technological Condition—An Anthology* (edited by Robert Scharff and Val Dusek, 2003).

and ideology critique with these views of technology from other disciplines.

In addition to re-historicizing these particular texts and contributing this interdisciplinary methodology, "The Body Machinic" aims to shift the direction of the current conversation about bodies and machines, which in Victorian studies often focuses on describing the fluidity or dissolution of the boundary between body and machine. Other scholars who similarly examine scenes of industrial labor have been quick to link their research to the recent scholarship on nineteenth-century prosthetics and the history of automata.[10] While this broader scholarly conversation has been important in generating interest in machines and technology within Victorian studies, it is fundamental to my argument that inquiry into the mechanization of the labor process be disentangled from other historical encounters between bodies and machines before we can begin to understand the relations among these images and between these sites of body/machine encounters. In addition, many critics who employ this approach focus on the fluidity and permeability of the boundary between body and machine; on the ways these encounters unravel categories of humanness and the organic; and on the ways subjectivities and embodiment (human, posthuman, and mechanical) are constructed through encounters

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[10] Contributions to the new interest in Victorian prosthetics include Tamara Ketabgian's "The Human Prosthesis: Workers and Machines in the Victorian Industrial Scene" (*Critical Matrix*, 1997), Erin O'Connor's *Raw Material: Producing Pathology in Victorian Culture* (2000), "Prefiguring the Posthuman: Dickens and Prosthesis" by Herbert Sussman and Gerhard Joseph (*Victorian Literature and Culture*, 2004), and the special forum on "Victorian Prostheses" in *Victorian Review* (2009) featuring articles by Genie Babb, Fiona Coll, and Tamara Ketabgian. Work on automatons includes Allison Muri's *The Enlightenment Cyborg: A History of Communications and Control in the Human Machine, 1660-1830* (2007), Jessica Riskin's edited collection *Genesis Redux: Essays in the History and Philosophy of Artificial Life* (2007), and Minsoo Kang's *Sublime Dreams of Living Machines: The Automaton in the European Imagination* (2011). Important recent scholarship on the general topic of Victorian technology includes Herbert Sussman's "Machine Dreams: The Culture of Technology" (*Victorian Literature and Culture*, 2000) and *Victorian Technology: Invention, Innovation, and the Rise of the Machine* (2009), Laura Otis's *Networking: Communicating with Bodies and Machines in the Nineteenth Century* (2001), Nicholas Daly's *Literature, Technology, and Modernity, 1860-2000* (2004), and Richard Menke's *Telegraphic Realism: Victorian Fiction and Other Information Systems* (2008).

between bodies and machines.[11] In Tamara Ketabgian's analysis of Factory Question literature in *The Lives of Machines: The Industrial Imaginary in Victorian Literature and Culture* (2011), for example, she identifies an "emphasis on prosthetic feelings and communities, on collective flows of force and influence, and on the uncertain limits of bodies, minds, and subjects," and she argues that "the Victorian industrial imaginary crucially prefigured" our own postmodern ideas about "cybernetics, prosthetics, artificial intelligence, animal cognition, and the posthuman" (3-4). In contrast to critics who identify a reified "body-machine relation," I argue that representations of relations between bodies and machines are always the product of human social relations that become embedded in the technologies of the labor process.

Finally, scholars working on Victorian technology have begun positioning their projects as correcting a predominantly "technophobic" stance that they claim has dominated Victorianist literary criticism. Herbert Sussman writes, "One would have little sense of Victorian machine dreams and the Victorian pleasures in machinery from the writings of contemporary Victorianists," and complains that critics have thus far told a biased and "anti-technological story" which has effectively excised "the positive feeling of the age toward its new technologies . . . the technological imagination, the Victorian sense of machine beauty" ("Machine Dreams," 197-98). Bizup and Ketabgian also claim to recuperate writing that Victorian studies has ignored through its practices of prioritizing nineteenth-century critiques of technology and ignoring the aesthetic, affective, and cultural components of Victorian technophilia. In failing to see these

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[11] For applications of these methodologies to the scene of industrial labor, see especially Jonathan V. Farina's "Characterizing the Factory System: Factory Subjectivity in *Household Words*" (*Victorian Literature and Culture*, 2007) and Tamara Ketabgian's *The Lives of Machines: The Industrial Imaginary in Victorian Literature and Culture* (2011).

cultural aspects of industry, they claim scholars have generally reproduced a technophobic and anti-industry stance inherited from the period's prioritization of culture as a corrective antithesis to the material realm of industry and commerce. Sussman advocates that "Engaging the technological, what we may call machine beauty or machine dreams, would productively modify the thesis of Raymond Williams that has shaped Victorian accounts of industrialism—the idea that the domain of culture, in the sense of high culture or art, was necessarily generated as a response to the narrow and impoverished nature of the industrial realm" (198). Bizup likewise participates in "current scholarship's ongoing contextualization of Williams's 'culture and society' tradition" (5) by arguing that the pro-industry side to the Factory Question debates developed a particular rhetoric "predicated upon the subversion of the antithesis between industry and culture" and that they advanced their pro-industry stance by praising "the aesthetic, social, and commercial importance of design for British manufactures" (4). Ketabgian similarly foregrounds her contribution by claiming that the division between (as she labels them) culture and technology, inaugurated a "technophobic stance" in Victorian culture which continues to exert its influence on scholars as it constituted a "founding moment of modern British literary and cultural studies" (9). Ketabgian's project aims to correct this by uncovering the emotional lives of machines—"industrial personalities"—and "thus questions our easy denigration of the 'mechanical' in a culture where machinery also represents our most powerful and unspeakable notions of emotion and community" (8, 14). In identifying the aesthetic (Bizup) or the affective (Ketabgian) in the Victorian industrial realm, scholars claim to refine or reverse Williams's culture/society argument, but they still assume that this is the primary context within

which we should analyze Victorian responses to industrialization. While these studies may point us to some of the cultural conditions within which "culture" in the Arnoldian sense came to dominate, I think that this kind of reading is limiting in that it prioritizes this traditional narrative while shutting down the necessity of locating other contexts for these texts or of prioritizing other more interdisciplinary historicist goals.

Furthermore, while I agree that we have indeed inherited particular forms of technophobia and technophilia from Victorian culture, my reading of Samuel Butler's utopian novel *Erewhon* will show that these take an entirely different form than these scholars assume, and are much more directly produced by responses to the mechanization of the labor process than yet recognized. By skirting this received need to place my readings either in line with or at odds with the grand narrative of Arnoldian Victorian culture, I've been able to produce a counter history that locates the source of Victorian technophobia before and beyond the later culture/industry split, arguing that both technophilia and technophobia are rooted in particular understandings of the effects of mechanization on the laboring body. Specifically, as this project takes as its primary argument, the categories of human labor and machine labor—newly constructed in the early-nineteenth century as categorically oppositional—provided the ideological foundation for a dichotomy that continues to structure our thinking about the relation between our bodies and the technologies that increasingly pervade our everyday lives. These perspectives are generally polarized into technophobic fears of machines controlling, dehumanizing, or replacing the laboring body, and technological determinist celebrations of new technologies as improvements to human life, offering the tempting promise of maximizing human efficiency. "The Body Machine" argues that both sides of

this dichotomous thinking function to mask the ways the apparent body-machine relation is always the product of human social relations that become embedded in the technologies of the labor process.

Chapter 1 historicizes cultural responses to the mechanization of the labor process through a theorization of how spatial and technological changes to that labor process allowed for greater control over the speeds, motions, rhythms, and intensity of factory labor, focusing on the textile industries. I begin with a close analysis of the "Factory Question" debates of the 1830s, initiated by reformers aiming to expose the horrendous working conditions of early industrial factories, including Kay's *The Moral and Working Condition of the Working Classes Employed in the Cotton Manufacture in Manchester* (1832) and Peter Gaskell's *The Manufacturing Population of England, Its Moral, Social, and Physical Conditions, and the Changes Which Have Arisen from the Uses of Steam Machinery* (1833). These critics claimed the machine's incessant demands turned the operative into a slave, an automaton unable to extricate itself from the demands of the "self-moving" mechanism. These images were directly contested by the political economic analyses produced by apologists for the factory system, including Ure's *The Philosophy of Manufactures* (1835), Edward Baines's *History of the Cotton Manufacture in Great Britain* (1835), and William Cooke-Taylor's *Notes of a Tour in the Manufacturing Districts of Lancashire* (1842). These writers celebrated machinery for relieving human labor, and they replaced the reformers' terrifying images with depictions of the factory as a healthy body comprised of harmoniously united "organs." These Factory Question debates provide a rarely recognized context for the graphic imagery in Karl Marx's *Capital, Volume 1*, in which workers are reduced to "living appendages" to

the monstrous, Cyclopean, "tyrant power" of the steam engine. Through new analyses of Marx's images in terms of their references to the Factory Question literature, the chapter's largest aim is to uncover Marx's outline for a historical materialist theory of technology, modeled in his critique of this earlier debate.[12] I argue that the images of machinery in *Capital* are not just representative of the capitalist in a symbolic or metaphorical sense; these images are meant to reveal machinery as the material form of the capitalist's social relation with the worker. This social relation becomes embedded in the technologies of the labor process, and so the capitalist's direct control over the labor process gives rise to images of a dominating or monstrous machine, like those Marx instructively employs in the factory chapters of *Capital*.

Chapter two turns to the factory workers' participation in the Factory Question debates through their autobiographies. In these texts, injured workers offer gruesome descriptions of violent machine accidents and bodies deformed and disfigured by factory labor, often describing the extent to which they were treated like machine part to be cast aside when broken or worn out. I examine a wide range of materials in this chapter and read them all as "autobiographical" in order to gain a more inclusive understanding of the

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[12] Marx's compelling language has prompted a wide range of interpretations, but the majority of his readers do not consider it within this historical context. Instead, critics from a Marxist theoretical perspective have interpreted these images in terms of the theory of alienation, while readers from a literary or cultural studies perspective attribute these images to a larger cultural technophobia, or identify in Marx's language historical instances of current critical vogues such as bodily fragmentation, cyborgization, or "shifting boundaries between human and machine" (Wendling 154). These interpretations of *Capital* share in common the view that "life" is somehow transferred from worker to machine, and that this transference constitutes the explanation for Marx's imagery and metaphors. a disparate range of studies including Amy Wendling's examination of alienation and technology in Marx; Ann Cvetkovich's examination of the sensationalized male body in *Capital* as compared to Victorian sensation fictions; Elaine Scarry's philosophical inquiry into the transfer of embodiment that occurs through the production of commodities; Felicity J. Callard's uncovering of post-modern concepts like "cyborgization" and "the posthuman" body in *Capital* with the goal of troubling the location of those formations as historically emerging only in the post-modern era; and Daniel A. Novak's identification of parallels between the "bodily fragmentation and reassembly" in *Capital* and the otherwise unrelated contemporary discourses of photography.

various means through which mostly illiterate workers had access to "life-writing" and the political use of their personal stories. I focus on *A Memoir of Robert Blincoe, An Orphan Boy* (1832), *A Narrative of the Experience and Sufferings of William Dodd, a Factory Cripple, Written by Himself* (1841), and the autobiographical portions of John Fielden's *The Curse of the Factory System* (1836), in addition to the interviews with injured factory workers reproduced in Dodd's *The Factory System Illustrated in a Series of Letters to the Right Hon. Lord Ashley* (1842), as well as the Parliamentary testimony that was made widely available through Blue Books and anthologies of evidence on the Factory Question like Charles Wing's *Evils of the Factory System Demonstrated by Parliamentary Evidence* (1837) and Samuel H. G. Kydd's *The History of the Factory Movement from the Year 1802, to the Enactment of the Ten Hours' Bill in 1847* (1857). The chapter argues that uncovering the political purchase of this life-writing requires a new theorization of how "the laboring body" is constructed as an abstraction in relation to the demands of the technologies of the labor process. As part of accomplishing this, the chapter intervenes in recent discussions of the need for a materialist theory of the body.[13]

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[13] Scholars of labor and working-class history, feminist historians, and cultural geographers have all in the past few years declared a need for a materialist theory that can do more than include class as one among the multiple forms of difference that become "marked" or "written" on "the body." Feminists in particular have usefully articulated the ways a focus on discursive construction limits access to a material body. Marjorie Levine-Clark finds that "Much of the theory relating to the body tends to deny its physicality, however, focusing instead on its constructed nature. . . . Indeed, only lately have feminists returned to the physical body as a subject of investigation" (6). Kathleen Canning adds: "The search for the 'material' body reflects, in part at least, an unease with the prevalence of the discursive or Foucauldian body" (502). Among the cultural geographers interested in this question, see in particular Felicity J. Callard, Robyn Dowling, and Robyn Longhurst. In 2007 the journal *Labor: Studies in Working-Class History of the Americas* produced a special forum headed by Ava Baron and Eileen Boris's article on "'The Body' as a Useful Category for Working-Class History." Though premised on the desire to explore new productive directions to meet the current needs of working-class history, the options its contributors proposed were nothing new. While Baron and Boris acknowledge that bodies "have been a site of struggle among workers and between workers and their bosses, manifested in conflicts over the labor process, over the choreography of bodily movements, and over control of the pace of work and the length of the workday," they resist analysis of the economics of these real-life bodily experiences (41). In an article

Drawing particularly upon the work of cultural geographer David Harvey, I produce a historical materialist theory of the body which foregrounds the fact that class struggle—and in many ways the revision of cultural conceptions of morally tolerable working conditions—requires renegotiation of the capacities and limits of this abstracted laboring body, a task in which I claim this range of working-class autobiographies were actively engaged.[14]

Chapter three argues that the period's industrial novels absolved the guilt and engaged the sympathies of their middle-class readership by constructing the deformed bodies and damaged health that resulted from factory labor as a problem of space, specifically by collapsing the issue of mechanization into dominant ideologies about the country and the city. I make this argument by analyzing two industrial novels which have received little attention in studies of the subgenre: Frances Trollope's *Michael Armstrong, Factory Boy* (1839-40) and Charlotte Elizabeth Tonna's *Helen Fleetwood* (1839-40).[15] These texts are generally considered to be the first true industrial novels, as

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appearing in the same year, Joan Sangster complains that feminist historians "completely neglect wage labour," citing the fact that "scholars both inside and outside working-class history see 'old-fashioned' approaches emanating from historical materialism as too deterministic or economistic for this recuperation project" (245, 268). Sangster follows Rosemary Hennessey in finding "a 'kernel' of materialist insight worth preserving . . . in the concept of surplus value: in the last resort, this inevitable expropriation of labour from workers' bodies is a driving force of capitalism," yet the article's historical case study does not offer a model for this kind of economic analysis (268-69). Geographer Reecia Orzeck pushes this question even further, challenging the "idea of the discursively produced body" and lamenting the fact that "although Marxists have been willing to rethink the social in terms of the corporeal, a historical materialist theory of the body remains only partially articulated" (497).

[14] Recent work in cultural geography useful to my materialist approach to the body includes Callard's "The Body in Theory" (*Environment and Planning D: Society and Space*, 1998), Dowling's "Classing the Body" (*Environment and Planning D: Society and Space* 1999), Harvey's *Spaces of Hope* (2000), and Orzeck's "What Does Not Kill You: Historical Materialism and the Body" (*Environment and Planning D: Society and Space*, 2007).

[15] The group of novels usually considered in literary studies of Victorian industrial fiction usually does not vary much from the selection made by Raymond Williams in *Culture and Society, 1780-1950* (1958). Important contributions to the assessment of these texts as a sub-genre include Ivanka Kovačević's *Fact into Fiction: English Literature and the Industrial Scene, 1750-1850* (1975), Catherine Gallagher's *The Industrial Reformation of English Fiction: Social Discourse and Narrative Form, 1832-1867* (1980),

they were the first to take working conditions and working-class people as their primary focus.[16] Though they were highly influential in carving out this new territory which would become a major thematic focus in many Victorian novels of the 1840s and 1850s, they are unique within the genre for bringing the reader inside the factory and depicting industrial machinery and workers at their labor.[17] Whereas the critiques of the factory system examined in Chapter 1 primarily theorized about the impact of a mechanized labor process on workers, and the autobiographies covered in Chapter 2 centered on the results of factory work, as novels *Michael Armstrong* and *Helen Fleetwood* are able to follow their characters' physical and moral development through time, space, and multiple forms of employment. They thus offer fully developed representations of the physical and moral effects of both idealized agricultural labor, which allows the worker to labor in tune with the natural rhythms of nature and the seasons, as well as the degradation and depravity that results when these same workers are transported into a

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Joseph A. Kestner's *Protest and Reform: The British Social Narrative by Women* (1985), Rosemarie Bodenheimer's *The Politics of Story in Victorian Social Fiction* (1988), Josephine M. Guy's *The Victorian Social-Problem Novel: The Market, the Individual and Communal Life* (1996), Susan Zlotnick's *Women, Writing, and the Industrial Revolution* (1998), Carolyn Lesjak's *Working Fictions: A Genealogy of the Victorian Novel* (2006), and Carolyn Betensky's *Feeling for the Poor: Bourgeois Compassion, Social Action, and the Victorian Novel* (2010).

16 William Godwin's novel *Fleetwood: The New Man of Feeling* (1805) was the first novel that treated child factory labor. Godwin's thorough research for this novel included factory tours, and though machinery was not quite as advanced in 1805 as it would become during the period of the Factory Question (1830s-50s), he witnessed and represented in his novel the exact same problems that writers would focus on decades later. However, unlike these later critics of the factory system, Godwin's descriptions are formed entirely by gothic tropes and imagery, demonstrating that the rhetoric I've observed emerged as a new formulation in the 1830s rooted in the debates on the factory question.

17 The most canonical of the period's industrial novels, including Charles Dickens's *Hard Times* (1854) and Elizabeth Gaskell's *Mary Barton* (1848) and *North and South* (1855), only ever bring their readers to the factory doors. Elizabeth Stone's *William Langshawe, the Cotton Lord* (1842) and Geraldine Jewsbury's *Marian Withers* (1851) are both directly concerned with the textile industry, but take as their focus the factory owners, and are not concerned to represent the workers' experience inside the factory. Charlotte Brontë's *Shirley* (1849) and George Eliot's *Felix Holt* (1866) similarly keep the actual scenes and people of labor at a distance, though their position is central to both novels' concerns. Representations of workers' living and working conditions are to be found in Benjamin Disraeli's *Sybil, or The Two Nations* (1845) and Charles Kingsley's *Alton Locke* (1849), though these do not involve factory labor.

factory town and forced to work like machines. Whereas agricultural labor cultivates the body's natural rhythms and movements, the imposition of the machine's incessant, mechanical demands eliminates workers' ability to choose to *not* be idle, thus foreclosing access to the moral benefits of hard work and leaving them susceptible to Socialism and Chartism. While clearly recapitulating the construction of human and mechanical labor as categorically oppositional, both novels avoid launching any direct critiques of machinery or industry by casting the problem as a moral, rather than a technological, failing. They argue that, while in the country the working class morally benefits from the paternalistic relationships built into agricultural labor, these relationships and the moral example of their superiors are absent from the factory system, and thus merely relocating from the country to a factory town engenders depravity and initiates workers' transformation into mindless automatons.

The final chapter shows how the oppositional categories of mechanical and human labor were at the center of Victorian debates about mental labor, intellectual property, and the emerging figure of the professional, focusing on the examples of mathematicians, inventors, and authors. While the Victorians generally reviled higher forms of math for supposedly mechanizing the mind of the student, Charles Babbage thought algebra's mechanical potential could accelerate the scientific pursuits of inventors, and he designed the Difference Engine (the first programmable computer), to take over the most mechanical aspects of their mental labor. Charles Dickens's novel *Little Dorrit* (1855-57) depicts in the character Daniel Doyce a combination of Babbage and Babbage's idealized inventor, while representing the characters beneath the inventor/genius in this hierarchical division of labor as mechanized by their mathematical

labors of industry, invention, and finance. The chapter demonstrates that our current conception of mental labor as productive of intellectual property is a direct inheritance of these Victorian efforts to establish the mental labor of the professional as unalienated and self-directed through its opposition to the monotony, repetition, and supposed mindlessness of mechanical labor.

The project's conclusion returns to the question of technophobia. I argue that the categories of mechanical and human labor which became defined in opposition to each other in early-nineteenth-century debates about the mechanization of the labor process provided the ideological foundation for a dichotomy that continues to structure our thinking about the relation between our bodies and the technologies that increasingly pervade our everyday lives. These perspectives are generally polarized into technophobic fears of machines controlling, dehumanizing, or replacing the laboring body, and technological determinist celebrations of new technologies as categorical improvements to human life, offering the tempting promise of maximizing human efficiency. As I show in my reading of the "Book of the Machine" chapters from Samuel Butler's utopian novel *Erewhon*, these two visions of the human relationship to technology come to comprise the two possible futures science fiction can imagine in which either humans become increasingly mechanical, or machines become increasingly life-like and eventually dominate humanity. The particular forms of technophobia and technophilia that dominate in our popular culture today are thus, I argue, a direct inheritance of the early-Victorian constructions of human and mechanical as categorically opposed, and of the resulting new kind of metaphor of the mechanized laboring body.

Chapter 1

"That Tyrant Power" and the "Living Appendage": Monstrous Machines and Mechanized Labor, from the Factory Question to *Capital*

Marx's chapters on factory labor in *Capital, vol. 1*, are famous for their fantastical images of monstrous "machines of Cyclopean dimensions" which violently "transform the worker, from his very childhood, into a part of a specialized machine" (506, 547). Marx repeatedly anthropomorphizes the machine to emphasize the steam engine's amazing power to control and mechanize the factory worker's body. Readers of *Capital* have given this imagery ample attention, focusing on Marx's accusations that, rather than workers using tools, the factory's monstrous machinery uses the workers "who are incorporated into it as its living appendages" (548). Though many readers have been drawn to these sections of *Capital* precisely because of the graphic imagery, they have failed to contextualize this language or trace its roots in the historical sources Marx drew upon for these chapters. Important to an understanding of Marx's monstrous machinery in *Capital* is therefore a careful reconstruction of his metaphors' origins in early-nineteenth-century British debates over the "factory question."

Concern with the "factory question" escalated following Parliament's committee investigations in the early 1830s into industrial factories and the slums that grew around them. The committee reports and testimonies given before Parliament prompted a wave of social critique aimed at exposing the factory's unhealthy working conditions and the extreme poverty and miserable lives of factory workers. These reform texts claimed that working with industrial machinery was physically and mentally debilitating and directly

to blame for the physical and moral degradation endemic to industrial towns. The specific critique repeated for decades across these debates is that working *with* a machine is bad for the body because it makes workers *like* a machine in mechanizing their bodies and thus turns them *into* a machine in body and mind. In response to these reformist texts, the pro-industry side of the factory debate featured apologists like the scientist Andrew Ure, whose propagandistic book *The Philosophy of Manufactures: or, an Exposition of the Scientific, Moral, and Commercial Economy of the Factory System of Great Britain* (1835) celebrates factories as achievements of English scientific and commercial progress. Ure rejects images of mechanized workers turning into machines and claims instead that factory labor is enjoyable, freeing, and joins workers and machines together in healthy organic harmony.

Marx's factory chapters draw heavily on both sides of the factory question debates, and he spends considerable time critiquing and abusing Ure's *Philosophy* in particular. *Capital*'s representations of the monstrous industrial factory transforming workers' bodies into mere mechanical appendages are in fact constructed in direct conversation with the images, rhetoric, and ideologies found in these earlier factory debates. Reading Marx's images in conjunction with these earlier writings therefore reveals the roots for his images of bodies turning into machines, as well as Ure's replacement imagery that refigures the factory as a harmonious healthy body. Marx's compelling language has prompted a wide range of interpretations, but the majority of his readers do not consider it within this historical context. Instead, critics from a Marxist theoretical perspective have interpreted these images in terms of the theory of alienation, while readers from a literary or cultural studies perspective attribute these images to a

larger cultural technophobia, or identify in Marx's language historical instances of current critical vogues such as bodily fragmentation, cyborgization, or "shifting boundaries between human and machine" (Wendling 154).[1] These interpretations of *Capital* share in common the view that "life" is somehow transferred from worker to machine, and that this transference constitutes the explanation for Marx's imagery and metaphors.

By recontextualizing Marx's language within the factory question debates, I will reinterpret this imagery and uncover the ideological function of these images and rhetorical maneuvers which characterize most nineteenth-century representations of the factory. The concern among reformers that bodies were turning into machines as well as the propagandistic responses to these fears which claimed the factory system united workers and machines into an organic, healthy body are both products of particular ideologies that arise along with and work to obfuscate the very real exploitation that was being increasingly and violently maximized by the introduction of new technologies into industrial factories. By giving central emphasis to the material conditions these metaphors were used to explain, I suggest that imagery representing the human / machine relation constitutes an ideological mystification of the material social relation between worker and capitalist. As I will show, this social relation becomes embedded in the technology which thereby becomes perceived as dominating and therefore monstrous. I

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[1] With these reductive and sweeping generalizations I am grouping together a disparate range of studies including Amy Wendling's examination of alienation and technology in Marx; Ann Cvetkovich's examination of the sensationalized male body in *Capital* as compared to Victorian sensation fictions; Elaine Scarry's philosophical inquiry into the transfer of embodiment that occurs through the production of commodities; Felicity J. Callard's uncovering of post-modern concepts like "cyborgization" and "the posthuman" body in *Capital* with the goal of troubling the location of those formations as historically emerging only in the post-modern era; and Daniel A. Novak's identification of parallels between the "bodily fragmentation and reassembly" in *Capital* and the otherwise unrelated contemporary discourses of photography.

propose that analysis of these representations of bodies and machines in the early factory question debates can therefore disclose the material social relation embedded in the technology, as well as the ideological mystification of this social relation. Marx's images of factories in *Capital* are therefore not mere rhetorical flourish, but a crucial part of his theory of technology.

Part 1: The Factory Question

Technological Determinism and the Ideology of Mechanism

Both critics and apologists for the factory system were constrained by a technological determinism that characterized the general nineteenth-century view of industry. An often-quoted passage from John Stuart Mill's *Principles of Political Economy* (1848) provides an apt example. In his discussion of the stationary state, Mill explains that this vision of economic leveling-off does not imply an end to technological and scientific improvements:

> Even the industrial arts might be as earnestly and as successfully cultivated, with this sole difference, that instead of serving no purpose but the increase of wealth, industrial improvements would produce their legitimate effect, that of abridging labor. Hitherto it is questionable if all the mechanical inventions yet made have lightened the day's toil of any human being. They have enabled a greater population to live the same life of drudgery and imprisonment, and an increased number of manufacturers and others to make fortunes. They have increased the comforts of the middle classes. But they have not yet begun to effect those great changes

> in human destiny, which it is in their nature and in their futurity to accomplish. (Book IV, Chapter VI, § 2, 116)

Mill asserts that in the stationary state technology will finally be able to realize what is in its "nature": the lessening of human toil. He is able to criticize the current state of technological advancement for failing to accomplish this because of the widely held assumption that this is the exact purpose of all scientific advancements. The ideology of technological determinism views social progress as motored and directed by technological progress. By this logic, all technological developments are categorically advances, signs and causes of human social progress, which is defined by the lessening of human toil. In this view, technology develops according to a teleological trajectory and by a self-propelling force, the logic of science propelling human society toward ever-increasing improvement. For Mill, this is precisely what is in technology's "nature" and "futurity to accomplish." In the context of the factory question, the cotton mills and machinery were taken as signs of national progress and England's commercial dominance over the cotton industry. To criticize the factory system therefore came dangerously close to criticizing machinery itself and to thus rejecting nationalism. England was soon to proudly assert its self-proclaimed status as "workshop of the world" and display its mechanical achievements in the 1851 Great Exhibition.

The logic of technological determinism and the intimate binding together of machinery, social progress, and English nationalism crucially shaped both sides of the factory question. The factory system's harshest critics were forced to contradict themselves and concede that the very same factories and machines that injured, deformed, and destroyed the health of their operators were nonetheless scientific

advancements that were categorically philanthropic in their inevitable purpose of lightening human labor. Even Friedrich Engels was forced to admit that "the nature of factory work . . . is, as the manufacturers say, very 'light', and precisely by reason of its lightness, more enervating than any other. The operatives have little to do, but must stand the whole time" (175). Engels's dilemma was common to the factory system's critics who similarly asserted that the machines they were condemning were also without a doubt labor-saving. To deny this would be to deny the purpose of science and the inevitability of English national dominance. As we will see, these writers were therefore at pains to explain how factory work, which was by definition easier, was also, as their assembled evidence sought to demonstrate, significantly more damaging to the body and mind.

A crucial feature of this technological determinism is a set of assumptions about machines which I am calling the ideology of mechanism. Along with the view that all technological developments are categorically advancements reducing human labor comes the assumption that all machinery is by definition efficient, precise, regular, and ever-increasingly automatic or "self-acting."[2] This ideology of mechanism ignores the fact that the machines that enabled the growing factory system, including the textile and cotton industries, were deeply flawed if measured by this technological deterministic ideal: they were far from "self-acting" and caused numerous problems; operated only with constant reliance on human workers; and in no way lightened human toil. One of the most

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[2] Louise Purbrick argues that "Perhaps the most persuasive ideology of industrialization is that machines are efficient. The strategy of increasing efficiency through increasing mechanization until automation is achieved is informed by an industrial ideology which features machines as clean, quick, continually useful. Efficiency is understood as the purpose of machines, as an indisputable mechanical attribute intrinsic to them as objects, but I would like to suggest that it is articulated in their images" (275).

common jobs in the cotton industry was as a "piecer" repairing all the threads the machines inevitably broke because they lacked the delicacy and self-awareness of human touch. Machinery can only be viewed as self-acting and automatic—the ideal that inventors constantly promised—if one ignores the workers who shovel coal into the steam engine, the workers who correct the machine's errors, and the workers who clean and maintain the machinery. The view that all English machinery was infallible, self-acting, efficient, and precise was more than a vindication of the superiority of English goods and English technological progress. These features came to comprise an ideological view of the categorical features of mechanism.

As mentioned above, all critics of the factory system faced the same dilemma: how to criticize the factory system when all good sense indicated that technological improvements lessened human toil and were increasingly self-acting. They had to find a way to explain how work that was supposedly easier could be actually physically damaging and exhausting to the worker. The ideology of mechanism presented one way of doing this. Since all machines are mechanical—regular, precise, self-acting—one can argue that these things make the work unhealthy because they place *mechanical* and therefore distinctly inhuman demands on workers' bodies. In the mass of writing produced to critique the factory system, these ideological assumptions about machinery comprise the exact characteristics that made factory labor so inhuman. Rather than measuring the extent to which machines eased human toil, these writers used the categories of human / inhuman and mechanical / organic as the defining parameters of mechanized labor.

Mechanization: Organization, Division, and Control of Labor

For examples of this critique of mechanized labor that conformed to the capitalist ideology of mechanism, we can turn to one of the most prominent texts in the factory debate, James Phillips Kay's *The Moral and Physical Condition of the Working Classes Employed in the Cotton Manufacture in Manchester*. Published in 1832, the same year as the Parliamentary committees' reports, Kay's book was one of the first to present to the public a full picture of factory workers' living conditions through detailed descriptions and statistical evidence. For Kay, the exact features which make machines technological wonders are exactly what make mechanized labor inhuman:

> [Workers] are engaged in an employment which absorbs their attention, and unremittingly employs their physical energies. They are drudges who watch the movements, and assist the operations, of a mighty material force, which toils with an energy ever unconscious of fatigue. The persevering labour of the operative must rival the mathematical precision, the incessant motion, and the exhaustless power of the machine. (24-25)

The features of the machine that the ideology of mechanism celebrated here become monstrous in their physical control over the worker; the machine is distinctly mechanical and therefore inhuman in its demands on the human body. Kay recapitulates the ideological assumption that all machines are categorically precise, efficient, and self-acting, and in his critique of mechanized labor these mechanical features comprise the exact definition of what human bodies are not. The "mighty material force" takes on an inhuman, monstrous presence—it is given the capacity for consciousness to show its rejection of fatigue, and the potential for exhaustion to show its untiring stamina—to

demonstrate that its powers and abilities are beyond the limits of human beings. To be mechanical is to be distinctly inhuman, and to be human is to be categorically imprecise, inefficient, and powerful and self-acting only to the point of inevitable exhaustion.

As a "medical man," Kay was viewed as an authority, and for decades after the book's publication his vivid descriptions were reprinted and quoted as factual evidence on the factory question. While the majority of Kay's book is devoted to depicting the squalid living conditions of the poor, his images of factory labor gained the most attention and were often quoted as key evidence in the debates and taken as serious accusations that needed to be aggressively refuted by factory system apologists. For example, Edward Baines's *History of the Cotton Manufacture in Great Britain*, written in the same year and from the same pro-industry perspective as Ure's *Philosophy*, quotes from Kay at length as an example of "the common prejudice that the steam-engine causes an incessant and unnatural strain on the powers of those who work in conjunction with it; no opinion has been more strongly expressed, or perhaps more generally believed, except among manufacturers themselves, yet none appears to me more utterly destitute of foundation" (457). On the contrary, Baines continues,

> Instead of the workmen being "drudges," it is the steam-engine which is *their* drudge: and as to their motions "rivalling [*sic*] the mathematical precision, the incessant motion, and the exhaustless power of the machine," nothing can be more mistaken. It is the very reverse of the fact. All the precision, power, and incessant motion belong to the machines alone; and the work-people have merely to supply them with work, to oil their joints, adjust their slight inaccuracies, and piece the threads broken

by the mechanical spinner. (460, original emphasis)[3]

Whereas Kay argued that the mechanical features of machinery—"precision, power, and incessant motion"—demand that workers also work like a machine, Baines claims these features in fact maintain the split between the mechanical labor of the machine and the human labor of the workers, taking over the drudgery and leaving only minor tasks requiring human delicacy and personal care.

Critics of the factory system were often outraged that the worker was being reduced to the slave of the machine, and apologists like Baines responded by asserting that, to the contrary, the machine was in fact the slave to the worker. These competing characterizations of the relation between man and machine created the perception that these are the two apparent options—either man dominates machine or machine dominates man—a view of technology which persists to this day. From a technological deterministic perspective endorsed by the factory system's apologists and still followed in certain sciences, progress is characterized by humanity's increasing control over the material forces of nature. The opposing technophobic perspective envisions a terrifying reversal in which technology increasing dominates man, replacing the human aspects of labor and degrading his role in the labor process. In *Labor and Monopoly Capital* Harry Braverman points out that these two apparent options form a false binary, and in fact the "relation" between man and machine is always the result of a human social relation. Machinery does not seek to dominate man, and society is not teleologically progressing to control nature through technological advancements. Rather, the labor process and the implementation of technology are the results of material social relations and struggles

[3] "The workmen who construct or attend upon all these machines are not to be confounded with the machines themselves, or their wear and tear regarded as a mere arithmetical question" (Baines 433-34).

over exploitation, coercion, and resistance. This is not to say, as many have, that the perception that the machine controls and dominates the worker, and the accompanying images (like Kay's) of monstrous technology, are *merely* imaginative projections of an exploitative relation between employer and worker. That perspective quite problematically ignores the lived physical repercussions of working alongside industrial machinery: disfigurement, deformity, exhaustion, and permanently damaged health. Instead, it is to say that this physical relation with the machine is the product of human social relations, and that rather than advancing teleologically toward the minimization of human toil or the maximization of human control over nature, incorporation of new technology in the labor process is a site of class struggle.

For obvious reasons, critics of the factory system only rarely pointed the finger at the exploitative social relations behind the human / machine relation. Instead they described the machine as monstrous in order to spectacularize the very real repercussions of the physical control it enabled the employer to have over the body of the worker by controlling the speed, regularity, rhythms, and intensity of labor. Critics often pinpointed the innovation of the factory system as a shift in power source, seeing the change from muscle to steam power as a shift in control from the worker to the machine. However, it was the reorganization of labor into the space of the factory that actually augmented social relations by creating more opportunities for struggle over control of the labor process. The organization of labor that the textile industry gradually replaced was a "putting-out system" wherein the worker would take materials home and be paid upon return of the finished product.[4] In that mode, labor was measured and paid for according

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[4] On the putting-out system, see MacKenzie, Lazonick, and Berg.

to quantity of product, and the worker had control over the speed, times, and intensity of his (and his family's) labor, often waiting until the family ran out of cash to begin the work commissioned. When this labor is relocated to the factory space, the employer gains a venue for struggle over the times of work. When this spatial reorganization is coupled with the implementation of industrial machinery powered by a central moving force (the steam engine), the employer gains the means for struggle over the pace, regularity, and intensity of the labor process. The real subordination of labor under capital—the capitalist's new opportunities for direct control over the worker's body in order to maximize exploitation—comprises the material change behind representations of the steam engine as controlling, powerful, and monstrous.

This reorganization of the labor process into the factory—the formal subordination of labor—is the prior step necessary to the mechanization of labor. The phrase "the mechanization of labor" refers in the most direct sense to replacing man-power, hand techniques, and individual skill with machines and as a result "deskilling" the worker and (along with the division and specialization of labor, of which mechanization is a key factor) degrading the worker's role to the increasingly repetitive, monotonous, and meaningless task usually done in attendance to the machine which does the bulk of the actual production. Theorists and historians have carefully explained the relation between mechanization and worker alienation, and some good studies have also been done on the relation between mechanization and the social, worker resistance to mechanization, and questioning the relation between mechanization and deskilling and degradation. What remains lacking is any historicization of the idea of mechanization itself. The assumption that the worker's body becomes mechanized through the

mechanization of the labor process has never been historicized or examined as an assumption, but rather taken for granted. Furthermore, the historical assumptions that machines have "mechanical" features which workers do not, and that the division of labor should be formed along these lines, has received no attention. This idea that bodies are mechanized has its origin in these early debates on the factory question. Critics of the factory system first highlighted exploitation by representing the ways machines controlled human bodies in making them move and work like a machine, thereby turning the body into a machine, and second criticized the mechanization of the labor process by accusing the machines of taking over the tasks that made labor human and leaving the worker to pursue degraded forms of labor, thereby making the worker like a thing, a machine. In these ways, representations of the mechanization of the labor process in the early nineteenth century came to focus on the ways that working *with* a machine turned the body *into* a machine.

The critique that the division of labor resulting from mechanization turns the worker into a machine develops directly from the ideology of technological determinism which claims that technology advances in order to take over more and more of the labor process and increasingly lighten human toil. Among the medical men examined before the 1832 Parliamentary Committee was Joseph Henry Green, surgeon at St. Thomas Hospital, who explained the advantages and disadvantages of mechanizing labor:

> [I]t is . . . necessary that the labourer should participate in the advantages and benefits arising from the employment of machinery, and in diminishing human labour by its use, the only legitimate purpose must be admitted to be that of substituting a machine for the performance of that

> labour which would reduce man to a mere mechanism, to the end that he may devote the time and leisure acquired thereby to his moral cultivation. . . . [W]e find that these human beings are only regarded as parts of the machinery which they set in motion, and with as little attention to their welfare . . . of degrading him into the class of means and things used, instead of recognising, as the end, his happiness and dignity as a moral and responsible agent. (qtd. in Wing 157)

In Green we see again the assumption that advancements in technology must of necessity be labor-reducing, yet we also see evidence of the prevalent anxieties about machines replacing human labor. The concern was—and continues to be for many critics of the labor process today—that the machine takes from the worker all the "interesting" and "rewarding" aspects of the production process, degrading the work to mindless, meaningless, and monotonous tasks. Here we see the logic by which, when the machine took over the labor and left the worker with nothing but meaningless tasks, mechanization degraded the worker's labor and turned him into a machine, a characterization defined by the repetition of mindless, monotonous, meaningless tasks. Because the work was no longer rewarding and because the tasks were no longer "meaningful," mechanization took over the human parts of work and dehumanized the worker. The contradiction within this logic is that the machine replaces human toil, and yet leaves for the worker the aspects of the labor process which could not be counted as rewarding when, according to Green, these are precisely the aspects of work that the machine should be taking over—those that would turn the worker into a machine himself.

One wonders what intellectual stimulation and rewards these critics believed

workers experienced prior to the division of labor in mechanization when they were making endless skeins of string by hand. What these critiques make visible is the idealizing of labor that would later come to characterize the Victorian era's "Gospel of Work" which recommended the ennobling and masculinizing effects of labor to the working classes particularly. Critics of the factory system claimed that working with a machine dehumanized the worker by taking over the exact aspects of work that would have elevated him intellectually and morally. Kay's important book launched a larger critique of the mental and physical effects mechanized labor had on workers, leading them directly into the lives of filth, debauchery, and squalor that he spent the majority of his book describing. Kay writes,

> Prolonged and exhausting labour, continued from day to day, and from year to year, is not calculated to develop the intellectual or moral faculties of man. The dull routine of a ceaseless drudgery, in which the same mechanical process is incessantly repeated, resembles the torment of Sisyphus—the toil, like the rock, recoils perpetually on the wearied operative. The mind gathers neither stores nor strength from the constant extension and retraction of the same muscles. The intellect slumbers in supine inertness; but the grosser parts of our nature attain a rank development. To condemn man to such severity of toil is, in some measure, to cultivate in him the habits of an animal. He becomes reckless. He disregards the distinguishing appetites and habits of his species. He neglects the comforts and delicacies of life. He lives in squalid wretchedness, on meager food, and expends his superfluous gains in

> debauchery. (22)[5]

Limited to attending to the needs of a machine, workers lacked intellectual stimulation and their minds were deadened by mechanical labor—the machine-like repetition of monotonous, minute actions—and from disconnection to the productive and rewarding aspects of labor. Appearing the year after Kay's book, Peter Gaskell's *The Manufacturing Population of England, Its Moral, Social, and Physical Conditions, and the Changes Which Have Arisen from the Uses of Steam Machinery* gives another instance of how this division of labor mechanizes the worker.[6] For Gaskell, the worker becomes part of the machine because "he will no longer be a man proud of his skill and ingenuity, and conscious that he is a valuable member of society; he will have lost all free agency, and will be as much a part of the machines around him as the wheels or cranks which communicate motion" (358).

Workers were also mechanized in being required to keep pace with machinery, the speed of which was of course controlled by the capitalist. Gaskell provides another instance where a critique of the material conditions of mechanization of the labor process becomes mechanization of the worker and a terrifying image of monstrous machinery turning the worker into a machine. For Gaskell, the steam engine is overwhelming in its relentless control over the worker's body.

> The labourer is indeed become a subsidiary to this power. Already he is condemned, hour after hour, day after day, to watch and minister to its

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[5] This highly influential passage is quoted by Friedrich Engels in *The Condition of the Working Class in England* (1844), and that passage in Engels is then quoted by Marx in *Capital*.

[6] We know Gaskell's text was popular because he rewrote it three years later, giving it a new title and reorganizing and the chapters to make it appear an entirely new book. Careful examination is needed to reveal that the content is the same, only reorganized into different chapters with new headings. This indicates a market for these kinds of social critiques, as well as Gaskell's position as authority and the wide dissemination of his ideas, especially among audiences who might have accidentally read his book twice.

> operations,—to become himself as much a part of its mechanism as its cranks and cog-wheels,—already to feel that he is but a portion of a mighty machine, every improved application of which, every addition to its Briareus-like arms, rapidly lessen his importance, and tend to drive him from participation with it, as the most expensive and unmanageable part of its materials. (143)

Critics of the factory system emphasized that their issue was not with hard work itself, for which everyone would agree the working classes were inherently suited, but that workers had to move and keep pace with a mechanical creature powered by a tireless steam engine. Robert Rickards, another medical man who gave evidence before Parliament, declared, "A man who has the entire mastery of his own limbs and person, may *work himself to death* if he pleases" (qtd. in Wing 414, original emphasis). It was not the freedom to work hard which Rickards wanted to legislate against, but rather factory labor wherein working until you die is no longer a matter of free will. He continues:

> This is peculiarly the case where human labour works in unison with the steam-engine, or the water-wheel. That tyrant power may at any time, and without any effort, cripple or destroy thousands of human beings, if not duly restrained. Human labour in these mills or factories is not on a par with other branches of industry. It is governed by a power that needs neither food nor rest; whence the avarice of masters and the stimulus of higher wages working on their men, may, and assuredly will, lead to excessive exertion, of which disease, *deformity*, or *death* are but *too certain* to be the unhappy results. (qtd. in Wing 414, original emphases)

Rickards's descriptions are typical in attributing ultimate power and control to the steam engine. Needing "neither food nor rest," the steam engine is personified as monstrous, not subject to the limits that characterize human labor. In these critiques of the factory system begins the awe and fear of the steam engine that would persist through the Victorian era. Like the expanding railway, industrial machinery was barreling forward out of control and could, "without any effort, cripple or destroy thousands of human beings, if not duly restrained."

Part 2: Andrew Ure

Ure's Philanthropic Science

Ure's *Philosophy of Manufactures* was published three years after the 1832 Parliamentary committee reports and is one of many texts that appeared in the second quarter of the century to directly refute statements like those made by Kay and Gaskell. Like Kay and many of those who were called upon to give evidence before Parliament, Ure claims authority on the factory system from his status as a well-regarded "medical man." Before pursing his interest in defending the atrocities of the factory system, Ure held the Chair in Natural Philosophy at Glasgow University and gained notoriety lecturing and publishing on subjects ranging from chemistry to astronomy to geology.[7] In his *Philosophy* Ure positions himself as a scientific authority, and in the opening pages states he will disprove false accusations about the factory system by presenting a

[7] See W. V. Farrar for a complete biography. Ure is perhaps remembered today as the scientist whose experiments might have helped inspire Mary Shelly's *Frankenstein*. "In 1818 Ure revealed experiments he had been carrying out on a murderer/thief named Matthew Clydesdale, after the man's execution by hanging. He claimed that, by stimulating the phrenic nerve, life could be restored in cases of suffocation, drowning or hanging."

supposedly more scientific exposition of industrial machinery. This scientific claim is important support for his defense of factories because it fits perfectly with the logic of technological determinism. He writes, "The constant aim and effect of scientific improvement in manufactures are philanthropic, as they tend to relieve the workmen either from niceties of adjustment which exhaust his mind and fatigue his eyes, or from painful repetition of effort which distort or wear out his frame" (8). The "niceties" and "repetitions" to which Ure vaguely refers recall the precision and efficiency assumed of all machinery as well as the assumption that these mechanical features define the tasks which the division of labor between man and machine should ideally consign to the machine. His explanation that the machinery in question is categorically labor saving is based in his own definition of the word "manufactures": "goods . . . made by machinery, with little or no aid of the human hand; so that the most perfect manufacture is that which dispenses entirely with manual labour" (1).[8] Ure's stated intentions for the book follow the logic of technological determinism exactly: he will demonstrate the "blessings which physic-mechanical science has bestowed on society, and the means it has still in store for ameliorating the lot of mankind" in order to remedy "the gross ignorance evinced by our leading legislators and economists . . . relative to the nature of those stupendous manufactures . . . . Till this ignorance be dispelled, no sound legislation need be expected on manufacturing subjects" (6-7).

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[8] This passage was incorporated into Ure's *Dictionary of Arts, Manufactures, and Mines* as part of his definition of "automatic." Wikipedia: "The great *Dictionary of Arts, Manufactures and Mines*, Ure's chief and most encyclopedic work, was published in 1837 for which he received 1,000 guineas. Further enlarged editions were rapidly called for in 1840, 1843 and 1853. After his death four further editions appeared, the last in 1878. This work was translated into almost every European language, including Russian and Spanish. *The Times* review said: 'This is a book of vast research, and the variety of subjects embraced in it may be estimated by the fact that on the French translation it was thought advisable to employ nineteen collaborators, all regarded as experts in their special subjects.'"

Ure provides evidence from his own observations which were confined entirely to visits to a few mills run specifically as "show places" for tourists.[9] He aims to show that factory labor is light and easy, taking pains to emphasize the philanthropic nature of industrial machinery which relieves workers of all hard labor, leaving them numerous breaks and leisure time. The children he observed were "always cheerful and alert, taking pleasure in the light play of their muscles,—enjoying the mobility natural to their age" (301). He claims it was a delight "to see them at leisure, after a few seconds' exercise of their tiny fingers, to amuse themselves in any attitude they chose . . . . [T]he work of these lively elves seemed to resemble a sport, in which habit gave them a pleasing dexterity" (301). Ure confirms these observations with Parliamentary evidence detailing the periods of idleness and rest built into factory labor. One report he cites states "periods of ¾ of a minute or more" exist where "nothing is to be done, not even attention is required . . . . Consequently, if a child remains at this business twelve hours daily, he has nine hours of inaction. And [if] he attends two mules, he has still six hours of non-exertion" (309-10). Another report he draws from claims those employed as scavengers "may be observed in cotton-factories idle for *four* minutes at a time, or moving about in a sportive mood, utterly unconscious of the tragical scenes in which they were dramatized" (311). In addition to frolicking about during these periods of rest, operatives are reported to "frequently exercise themselves by following the movement of the lay, and leaning on it with their arms" (311), while those employed as mule-spinners have time to read

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[9] Farrar notes that Ure made these observations while on a relaxing vacation: "In 1833, Ure engaged in a long series of large-scale experiments on the refining of cane sugar . . . but seriously underestimated the time needed to complete it, and suffered from 'anxiety of mind and bodily fatigue'. To recuperate, in the autumn of 1834 he embarked on a tour of the manufacturing districts of Lancashire, Cheshire, and Derbyshire 'with the happiest results to his health' (65), staying longest at the show places, such as Quarry Bank Mill at Styal. It was on this brief tour that he based his *Philosophy of Manufactures*" (315).

numerous books, being "so much at their ease, that they might study the circle of the sciences in the course of their business" (370-71).

Ure's major source of evidence is E. C. Tufnell, another medical man who provided Parliamentary evidence in 1832.[10] Tufnell's statement was among the most widely quoted from the Parliamentary reports, and for decades after he remained the most persuasive source pro-industry writers could marshal to prove machines made factory labor easier. Tufnell's words were used in propaganda aimed at the working class as well; for example, a lengthy extract from his statement is used to head an article in the *Mechanics' Magazine* in 1834 titled "The Steam-Engine, the Cotton-Spinner's Best Friend." Ure borrows heavily from Tufnell throughout his *Philosophy*, even reproducing some of his most well-known statements, including the following, without quotation marks as if to present them as his own:

> Of all the common prejudices that exist with regard to factory labour, there is none more unfounded than that which ascribes to it excessive tedium and irksomeness above other occupations, owing to its being carried on in conjunction with the "unceasing motion of the steam-engine." In an establishment for spinning or weaving cotton, all the hard work is performed by the steam-engine, which leaves for the attendant no hard labour at all, and literally nothing to do in general; but at intervals to perform some delicate operation. . . . And it is so far from being true that the work in a factory is incessant, because the motion of the steam-engine

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[10] Gray describes Tufnell, the commissioner for Lancashire, as "a cleric with leanings to political economy, and subsequently author of a well-known pamphlet on trade unions," an exposé piece on the "secret source" of working-class agitation for a Ten Hours Bill (70).

> is incessant, that the fact is, that the labour is not incessant on that very account, because it is performed in conjunction with the steam-engine. Of all manufacturing employments, those are by far the more irksome and incessant in which steam-engines are not employed . . . and the way to prevent an employment from being incessant, is to introduce a steam-engine into it. (309)

Perhaps Tufnell's statements became the favorites of scientists and propagandists alike because, rather than claiming that mechanized labor is tolerable for factory workers, he acknowledges that mechanical labor is distinctly unsuitable for humans. He admits that mechanized labor is "unceasing"—repeating the word "incessant" four times in the space of two sentences—but argues that as these are the features of mechanism, only a machine's labor can be mechanized. The division of labor between man and machine therefore leaves for the worker only those tasks which are distinctly human in that they form the binary opposite to mechanized labor. Whereas the machine is "incessant," human workers have "nothing to do in general" and "no hard labour at all" except the occasional "delicate operations" which require human sensitivity to detect.

Ure's Organic Factory

Ure goes further than Tufnell. He claims that, far from making the worker machine-like and turning him into a "crank or cog-wheel" (Gaskell 143), factory labor actually incorporates the worker in harmonious organic unity with the machine. For Ure, the factory is a body within which human and machine are organically linked as living parts of the factory organism. He states that "the perfection of automatic industry" is to

be found in a cotton mill where "the elemental powers have been made to animate millions of complex organs, infusing into forms of wood, iron, and brass an intelligent agency" (2). Whereas for critics like Kay the machines became life-like to demonstrate that the steam engine, their inexhaustible power source, was inhuman and monstrous, for Ure machines are life-like in structure and complexity of detail:

> [T]he processes that may be employed, to give to portions of inert matter, precise movements resembling those of organized beings, are innumerable, as they consist of an indefinite number and variety of cords, pulleys, toothed-wheels, nails, screws, levers, inclined planes, as well as agencies of air, water, fire, light, &c., combined in endless modes to produce a desired effect. (9)

Ure's emphasis on complexity of structure is part of his careful attempt in the opening pages of his *Philosophy* to explicate the evolution of industrial machinery out of eighteenth-century automatons. He devotes considerable space to describing several famous historical automatons and measures their success in terms of their replication of organic form, structure, and function. For the examples Ure lingers over—including the flying pigeon of Archytas, the Android of Albert the Great, the flute-player of Vaucanson, and the chess player of M. Maezel—looking for a motive power would actually potentially lead to disappointment by revealing a human manipulator (9-10). However, like the machines that replace human workers in certain aspects of the labor process, these machines were celebrated in Ure's time for their ability to imitate and replace organic beings. The duck is his favorite example:

> The duck of the same celebrated mechanism, not only imitated the

> different movements of this animal, drinking, gobbling, swallowing, &c., but also represented faithfully the structure of the internal viscera for the digestion of the food. The play of every part necessary to discharge these functions was imitated to the life; for the duck drank, dabbled in the water, stretched out its neck to take grain when offered to it in the hand, drew back its head again to swallow it, doubled the quickness of the masticating movements in passing the grain into the stomach, like the living duck, which always swallows its food very hastily. The grain was then ground in the gizzard, as prepatory to digestion; and finally subjected to excrementitious actions. Its wings, neck, head, and whole frame, were imitated bone by bone, and arranged in their natural form and order. When once wound up, the duck went through all its vital evolutions without needing to be touched. (10-11)

The pooping duck is a technological wonder because its mechanical structures replicate organic structures in form and function and achieve the same (and perhaps improved) results. Ure's only lament is that none of these automata were designed to serve human needs. That is, until their intentions were expanded upon to create similarly "self-acting" industrial machinery (11). Ure claims factory machines, like automata, merely replicate organic structures and functions, and therefore their purpose is to replace human bodies and relieve them of labor.

> [Richard] Arkwright alone had the sagacity to discern . . . how vastly productive human industry would become, when no longer proportioned in its results to muscular effort, which is by its nature fitful and capricious,

> but when made to consist in the task of guiding the work of mechanical fingers and arms, regularly impelled with great velocity by some indefatigable power. (15)

Though Arkwright was famous in Ure's time for inventing the spinning frame, Ure characterizes his innovation not as revolution of method, but as the supersession of human labor through the replication of human body parts, replacing them with "mechanical fingers and arms" which would never tire or be "fitful and capricious."

Throughout his *Philosophy* Ure maintains this equivalence between industrial machinery—with its "slender shafts, like small sinewy arms"—and the bodies it replaces (36). This is more than simply a metaphor useful to Ure in combating his opponents' images of monstrous machines. In claiming that all of these parts of the factory together form a vast body, Ure is able to characterize the relation between bodies and machines as one of harmonious organic unity and, in an important contradiction, also distinctly controlling and disciplinary. Crucial to both of these seemingly contradictory characterizations is the role of the steam engine as central moving power. Rather than a monstrous "tyrant power," however, Ure's factory contains a "two-fold heart, or twin steam-engines" that carefully regulate the flow of power "to prevent arterial throbbing or tremor" in the "productive organs" (34). Like the organs of a body, machines and workers are connected to the steam engine by "grand nerves and arteries which transmit vitality and volition, so to speak, with due steadiness, delicacy, and speed, to the automatic organs. Hence, if they be ill-made or ill-distributed, nothing can go well, as happens to a man labouring under aneurismal and nervous affections" (32). The health of each "organ" is maintained by the regularity of the central engine, thus contradicting

accusations about speed-ups and machinery's inhuman pace. According to Ure's definition, a factory, "in its strictest sense, involves the idea of a vast automaton, composed of various mechanical and intellectual organs, acting in uninterrupted concert for the production of a common object, all of them being subordinated to a self-regulated moving force" (13-14). In all of these images, the steam engine functions as the body's central nervous system directing and transmitting power to all the component parts and is regulated organically as part of the body itself. However, the fact that all organs—human and mechanical alike—are "s*ubordinated* to a self-regulated moving force" points up the central contradiction in Ure's argument. While he describes industrial machines as labor-saving and factory work as light, easy, and freeing, he also constantly argues for the disciplinary effects of factory labor.

One of his aims here is to demonstrate that machines discipline workers to factory labor, transforming the independent domestic artisan into a docile subordinate. For Ure, this comprises the greatest achievement of Arkwright's innovation:

> The main difficulty did not, to my apprehension, lie so much in the invention of a proper self-acting mechanism for drawing out and twisting cotton into a continuous thread, as in the distribution of the different members of the apparatus into *one co-operative body, in impelling each organ with its appropriate delicacy and speed, and above all, in training human beings to renounce their desultory habits of work, and to identify themselves with the unvarying regularity of the complex automaton*. To devise and administer a successful code of factory discipline, suited to the necessities of factory diligence, was the Herculean enterprise, the noble

> achievement of Arkwright. Even at the present day, when the system is perfectly organized, and its labour lightened to the utmost, it is found nearly impossible to convert persons past the age of puberty, whether drawn from rural or from handicraft occupations, into useful factory hands. After struggling for a while to conquer their listless or restive habits, they either renounce the employment spontaneously, or are dismissed by the overlookers on account of inattention. . . . [I]t required, in fact, a man of Napoleonic nerve and ambition, to subdue the refractory tempers of work-people accustomed to irregular paroxysms of diligence. (15-16)

At several points Ure promises readers that it is the particular ability of mechanized labor to discipline and train workers into submission. It does this, contradictorily, by connecting them into an organic body *and* by making them machine-like. As parts of a "co-operative body" workers are impelled to give up their human flaws—"listless or restive habits," "refractory tempers," and "irregular paroxysm of diligence"—to become mechanized and "identify themselves with the unvarying regularity of the complex automaton." The "successful code of factory discipline" to which Ure refers historically involved a system of fines that docked workers' pay for their behavior, lateness, or a number of minor infractions. Moreover, the reason why Ure and Arkwright found children before the age of puberty more successfully disciplined to factory labor is that as children they could be beaten severely for disobeying, falling asleep at the machines, or frolicking about in the exact manner Ure earlier claimed he delighted in observing. These "disciplined" workers are also the same ones Ure claimed are given ample leisure to use

as they wish and are freed from mechanical "unvarying regularity" by the human / machine division of labor. How is it that, at the same time that the machine gives the worker freedom, it also takes ultimate control over his body and mind, disciplining and subduing his distinctly human qualities and turning him into part of a well-oiled machine?

Factory Discipline and the Social Body

Ure achieves this contradiction because he anthropomorphizes the machine and depicts the factory as a local instance of the social body. The nineteenth-century metaphor of the social body, which developed from the earlier concept of a body politic, imagines "the population as a unified and specifically corporeal whole" (Gilbert xiv). Its formation reflected new modes of assessing and measuring social health and normalcy and "a new view of the role of the state as manager of physical health and facilitator of social cohesion" (Gilbert xiv). This is, in fact, the opening metaphor of Kay's *The Moral and Physical Condition of the Working Classes*, one of the first instances of its direct articulation:

> The sensorium of the animal structure, to which converge the sensibilities of each organ, is endowed with a consciousness of every change in the sensations to which each member is liable; and few diseases are so subtle as to escape its delicate perceptive power. Pain thus reveals to us the existence of evils, which, unless arrested in their progress, might insidiously invade the sources of vital action. Society were well preserved, did a similar faculty preside, with an equal sensibility, over its

> constitution, making every order immediately conscious of the evils afflicting any portion of the general mass, and thus rendering their removal equally necessary for the immediate ease, as it is for the ultimate welfare of the whole social system. The mutual dependence of the individual members of society and of its various orders, for the supply of the necessities and the gratification of their desires, is acknowledged, and it imperfectly compensates for the want of a faculty, resembling that pervading consciousness which presides over the animal economy. (17-18)

Kay sees all parts of society as organically connected like a living body; disease in any one section will impair the health of the system overall.[11] He regrets that, unlike an actual body, society lacks any "sensorium" or central nervous system to link the distant parts and instantly communicate local problems to the other sectors. Kay goes on to claim that his text's investigation into factory workers' living conditions is important because transmission of written knowledge is the only available substitute for the lack of a presiding "consciousness." He argues specifically for the necessity of increased statistical information which can supply, where detailed reports are lacking, a more "perfect portraiture of the features of each individual part of the social body" (18).[12]

Ure uses the metaphor of the social body to combat critiques of factory labor as

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11 From a review of Kay's book: "The various orders of society are mutually dependent; their interests are interwoven with a complexity which cannot be unravelled [*sic*]; and natural connexions [*sic*] tend to diffuse throughout the mass the happiness or misery suffered by any particular portion" (380).

12 The metaphor of the social body was used as an argument justifying government interference in matters of economics as relative to social health, a prime example being the factory acts. By demonstrating that the factory system was linked by the "sensorium" of the central moving power of the steam engine, the metaphor of the social body thus allowed Ure to institute himself as an authority, the scientific expert on technology, comparable to the authority Kay granted to a government armed with statistics. See also Mary Poovey's work on Kay and the social body in *Making a Social Body*.

exploitative and violently damaging. Joseph Bizup, in his excellent study of the pro-industry contributions to the factory question debates, argues that Ure and his followers Edward Baines and William Cooke-Taylor depict the factory as a healthy body as evidence of the health of individual workers and to demonstrate that the factory is a healthy part of the overall social body—not at all the diseased member to which Kay seeks to alert the rest of the social body. In addition to a claim to bodily and therefore social health, Ure's use of the social body image allows him to assure readers that factory labor disciplined the working class by binding the individual refractory worker to a central power source as a controlled appendage. The image of the social body is therefore the crucial binding logic in Ure's argument that allows him to unite his two seemingly contradictory claims—that factory labor is both freeing and disciplinary. By likening the factory to the social body which unified society, Ure's imagery transforms the machine into a source of the "physical health" and "social cohesion" promised by liberal ideals for a disciplinary society (Gilbert xiv). By tapping into this emerging ideology, Ure's bodily imagery therefore resolves the apparent contradiction in his claims about industrial machinery. While, as Kay explained, society lacks a central sensorium, making the state's interventions into people's lives therefore permissible and desirable, Ure positions the machine as exactly that central controlling sensorium and, by thus removing the greedy capitalist from the picture, depicts the machine as the nervous system of the factory body, monitoring and ensuring the health of all its members.[13]

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[13] Steve Edwards emphasizes the image of the social body in his analysis of Ure's *Philosophy*, drawing attention to Ure's "particular medical training under the Scottish anatomists [which] emphasized the central role of the nervous system as the unifying system of the body," and arguing that this image was crucial for Ure to establish himself as a scientific authority over the factory system like its "brains and nerves."

Ure's use of the social body image also reverses Kay's location of the source of the social body's potential ill health, thus bolstering his argument that the factory produces a disciplined workforce and calming middle-class fears of worker revolt. While Kay claims the factory system is the source of ill social health, which spreads from the factory to the squalor of surrounding urbanized areas, Ure locates the germ of the illness in the individual refractory worker who chooses to disrupt the factory's bodily health.[14] Unions and strikes, he claims, are the means by which workers willfully damage the body of which they are a dependent part: "It is one of the most important truths resulting from the analysis of manufacturing industry, that unions are conspiracies of workmen against the interests of their own order, and never fail to end in the suicide of the body corporate which forms them" (41). In these cases the willfully disruptive worker turns the social body upside-down, and "the inventive head and the sustaining heart of trade [are] held in bondage by the unruly lower members" (282). For Ure, the grand achievement of Arkwright's factory is that the introduction of machine labor offered a means of disciplining the worker in mind and body. In addition to making the worker aware of the organic cohesion with which he connects to the entire factory, and therefore discouraging his formation of alternative "combinations" (unions), working at a machine forces the worker to change his habits and attitudes:

> [W]hen the handicraftsman exchanges hard work with fluctuating employment and pay, for continuous labour of a lighter kind with steady wages, he must necessarily renounce his old prerogative of stopping when

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[14] "By the infirmity of human nature it happens, that the more skillful the workman, the more self-willed and intractable he is apt to become, and, of course, the less fit a component of a mechanical system, in which, by occasional irregularities, he may do great damage to the whole" (20).

> he pleases, because he would thereby throw the whole establishment into disorder. Of the amount of the injury resulting from the violation of the rules of automatic labour, he can hardly ever be a proper judge; just as mankind at large can never fully estimate the evils consequent upon an infraction of God's moral law. (278-79)

For Ure, the ordered (i.e. incessant and monotonous) movements of the machine make the worker who must follow those movements a likewise ordered and therefore compliant member of a unified society.

Ure's insistence on the disciplinary effects of the social body offers a compelling illustration for a Foucauldian account of the early nineteenth century's shift to a disciplinary society, and his mention of the "amount of the injury resulting from the violation of the rules of automatic labour" recalls the bodily violence which threatens deviants (279). While Ure's social body imagery and his claims to disciplinary control certainly invite this Foucauldian diagnosis, his text has actually received the most attention from economic and labor historians, and it is within this conversation that I find the most profitable way of understanding Ure's claims which, ultimately, are merely propagandistic rhetoric. These historians have examined the early factory system and debate the extent to which it was in fact truly disciplinary, seeking to demonstrate instead the ways early factory labor was experienced and resisted as recorded in the history of class struggle. E. P. Thompson's classic study of work-time, for example, examines the new demands made on workers' time, energies, and prior inclinations, which were forcefully resisted by workers accustomed to earlier cultures of labor.[15] William

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[15] Thompson also describes the crucial role of machinery in the shift away from task-oriented

Lazonick's also highly influential study demonstrates the ways the reorganization of labor into the space of the factory actually enabled the solidification of working-class collectivity and facilitated shop-floor resistance.[16] While I do not here seek to contribute to this history of the material experiences of industrial machinery or to theorizations and representations of worker struggles and resistance, I do rely on the alternate history they provide as it illuminates the ideological nature of Ure's propagandistic claims about factory discipline. Viewed within this context, Ure's claims about discipline invite an ideological critique examining the ways changes in the mode of production—new forms of control over the labor process, specifically the use of machines to control the laborer's body—were rationalized and naturalized in texts like Ure's, and the ways these representations work to mystify the crucial role of industrial technology in the social relation between worker and capitalist.

Part 3: Karl Marx

Ideology Critique and Technological Change

The ideological implications of Ure's imagery include a mystification of the role

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labor, as machinery's regular rhythms allow one to calculate the rate and quantity of work to be accomplished in a given period of work-time belonging to the employer.

16 There has been a great deal of interest from economic historians in locating technological developments and representations of technology like Ure's in the history of class struggle, and these histories often take as their starting point the now accepted accusation that Marx followed Ure's claims too readily and accepted as fact his idealized history of industrial machinery and factory operations. In *Capital*, where Marx subjects Ure to an otherwise scathing critique, he displays the limits to available historical knowledge; he writes, "it would be possible to write a whole history of the inventions made since 1830 for the sole purpose of providing capital with weapons against working-class revolt. We would mention, above all, the self-acting mule" (563). Starting from this point, historians have uncovered a much more complex history of class struggle. For example, Lazonick's highly influential study of the implementation of the self-acting mule has shown that capital's reorganization of workers within the space of the factory in many cases actually facilitated unionization and worker organization because it cemented (rather that dissembling, as was previously believed) the hierarchical relations that secured the place of adult male workers as supervisors and in many cases the direct employers of their child assistants.

of technology in social relations as outlined by Marxist theorists of the labor process.[17] Ure's claim that machines discipline workers assumes that factory workers are flawed, both innately and in their behaviors and customs. The need to change them morally and culturally is therefore the problem that he proposes large scale machinery can solve by adapting them to the requirements of a unified society. Ure's logic here combines two separate things: the desire to make workers adjust to new cultures of work (showing up on time, etc.) and the physical discipline violently imposed by working with a regularly and incessantly moving machine. This notion of discipline whereby intensity of labor is ideologically conflated with the cultural and moral improvement of the working classes (according to Victorian / liberal / middle-class values) masks the ways that the machinery embeds capitalist social relations into the labor process. Far from making the worker act more middle-class, factory machines are the material form of the capitalist's social relation with the worker: machines are the means by which, through enabling direct control over the worker's body, the capitalist can maximize extraction of surplus value and minimize worker resistance.[18]

The process through which social relations become embedded in the technologies

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17 In the following section I rely on the following theorists and historians of the labor process: Stanley Aronowitz, Maxine Berg, Harry Braverman, Michael Burawoy, David Harvey, Donald A. *MacKenzie,* Stephen A. Marglin, *Paul Thompson, and Mark Wardell.*

18 In emphasizing *the means,* I hope to clarify that I am here focusing on the role of machinery in particular social relations. Introduction of large-scale industrial machines of course did not mean that the worker was controlled in any complete or absolute sense; workers certainly found many ways of resisting and otherwise slacking off. The function of the category "direct control" serves to classify the means by which the intensity of labor and the worker's body can be controlled in the labor process. Direct control is of course only one of a range of strategies involved in coercion and management of the work force. See Burawoy and MacKenzie, 40. Richard Edwards uses the term "technical control" to describe "designing machinery and planning the flow of work to minimize the problem of transforming labor power into labor as well as to maximize the purely physical based possibilities for achieving efficiencies. Thus a social dimension, the inherent class nature of capitalist production, is added to the evolution of technology" (112).

of the labor process, Marx labeled the *real subordination* of labor under capital.[19] Prior to the real subordination, capital simply takes over existing labor processes, introducing the buying and selling of labor power into existing modes of production—this is the mere formal subordination.[20] The real subordination is the (constantly evolving) process whereby, through the application of science and technology, this social relation between worker and capitalist comes to penetrate and transform the labor process itself so that it takes on the form of the social relation.[21] Thus capital gradually *transforms* social relations and the labor process "until they become thoroughly imbued with the nature and requirements of capital, and the labour process is *really* subsumed under capital."[22] The institution of large-scale machinery was a crucial part of this process of real subordination because this technology allowed the labor process to take on the characteristics and the form of the social relation.[23] Specifically, when all the machines in

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[19] Marx discussed this in the so-called "lost" chapter of *Capital, vol.1*, now included as an appendix, "Results of the Immediate Process of Production," 1019-38.

[20] The earlier stages in the development of the factory system include the putting out system, in which the capitalist became a middle-man, supplying raw materials and paying workers upon the work's completion; then the introduction into the putting-out system of small-scale machinery owned by the capitalist but located in the worker's home; then the relocation of these machines into the space of the factory. In all of these forms of production, the actual labor process stays much the same. While the capitalist gains some greater control over *the work* by gaining the ability to control the equipment and the conditions under which it is used and thereby control quality and minimize potential for embezzlement of raw materials, these innovations enable no direct control over *the worker*. The worker still has ultimate control over the times of labor (the machine only starts when he begins to work on it and it stops whenever he decides it does) or the speeds and intensity of labor. This lack of direct control over the labor process is why the capitalist had to hire people to beat his workers. See Aronowitz, Berg, and Lazonick on the putting-out system.

[21] "With the real subsumption of labour under capital a complete (and constantly repeated) revolution takes place in the mode of production, in the productivity of the workers and in the relations between workers and capitalists" (Marx, "Results" 1035).

[22] For example, as David F. Noble as shown, different technologies were invented and advanced in Britain and America for use in their respective textile industries. The technologies advanced in the different ways they did because of the different pre-existing social relations between workers and employers. In this example, the technology used is in no sense the best, most useful, most advanced, etc. Rather, the technologies that took hold in each nation's textile industry are the ones that correspond with and come to embed the simultaneously emerging social relation between worker and capitalist in that industry.

[23] See Berg's *The Age of Manufactures* for a useful overview of the debates about "the relationship between the economic and social history of work and the process of technological change" (170)

the factory could be linked to the central moving power of the steam engine, this technological innovation enabled the factory owner to gain control over the speed, intensity, and times of the labor process. This has been called a shift from the control over work to the control over the worker. In this way, social relations become embedded in the technologies of the labor process, the technologies being the way that the social relations (of exploitation and extraction of surplus value) are maximized on the shop floor.

This theory of technology explains Marx's imagery in *Capital* of monstrous machinery: it is not merely a metaphor for capital's evils generally, but a representation of the extent to which the particular technologies of large-scale industry embed particular social relations in the labor process. Marx writes, "Because *it is capital*, the automatic mechanism is endowed, in the person of the capitalist, with consciousness and a will. As capital, therefore, it is *animated* by the drive to reduce to a minimum the resistance offered by man, that obstinate yet elastic natural barrier" (526, my emphases—we must remember that Marx specifies that "capital" is a social relation). The technology developed and instituted in the factory system was implemented to "reduce to a minimum the resistance offered by man" by increasingly maximizing the capitalist's direct control over the labor process by supplying the means for control over the worker's body.[24] Therefore, because industrial technology embeds and is a material form of capitalist social relations, for Marx analysis of technology can disclose the social relations

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concerning the Industrial Revolution generally. Berg proceeds to offer a very useful examination of this relationship in the technological developments of the early textile industry specifically.

[24] Mackenzie clarifies that capital does not seek direct control as a goal in of itself; there is no reason to suppose that direct is preferable or more cost effective than indirect forms of control, and direct control is only one of a range of strategies involved in coercion and management of the work force (40).

embedded in the labor process: "Technology reveals the active relation of man to nature, the direct process of the production of his life, and thereby it also lays bare the process of the production of the social relations of his life, and of the mental conceptions that flow from those relations" (493, n.4).[25] My focus here is not to analyze the actual machine technologies of the early factory system. Rather, my aim has been to examine the mystifications surrounding these technologies, those mystifications—which largely arise at precisely the moment of the introduction of new technologies—that obscure so as to naturalize the social relations embedded in technologies. I contend that ideology critique can uncover the mystification of class relations through an analysis of the representations of the relations between worker and machine, humans and technology, like those I have assembled here.

Real interest in the labor process and the aspects of it I have just described began with Harry Braverman's path-breaking study in 1974, *Labor and Monopoly Capital*.[26] In fact, before Braverman most Marxists gave little attention to chapters 14 and 15 of *Capital*.[27] While Braverman's work has been subjected to a variety of critiques, he is well worth returning to for his examination of mechanization, in which he follows Marx

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[25] This passage is emphasized by David Harvey, who parses it thus: "Technology is the material form of the labour process through which the underlying forces and relations of production are expressed . . . so an analysis of actual technologies can 'disclose' the nature of the productive forces and the social relations embedded within the capitalist mode of production" (100).

[26] Braverman's focus is on Taylorism and the increasing scientific management and degradation of labor which he sees as becoming pervasive characteristics of our lives even outside of the workplace. "In Taylor's notions and practices of scientific management, Braverman saw one recurring theme: to directly influence the effort of workers while maintaining control over the intended purpose of their activities. In Braverman's terminology, the recurring theme is one of finding ways to separate the conception of a task from the execution of a task, thereby transferring knowledge and power to management. The addition of new technology, the introduction of new work rules, changes in the wage formulas as well as the level of direct supervision result from management's recurring effort to control the physical and mental effort of employees" (Wardell 4-5). Braverman's theory has been heavily critiqued for the separation of "conception" and "execution."

[27] MacKenzie (270, n.22).

closely.[28] Braverman returns to these factory chapters to ground his larger analysis of mechanization as a means of capitalist control. He claims the function of machinery (and therefore the motive behind technological development) is exploitation of surplus value through the increased capacity to control the speed, intensity, and times of production. For Braverman, an important result of the exploitative function of machinery is that workers attribute to the machine the powers which arise from social relations and come to view the machine as the enemy. Braverman argues that this is a fetishism, the reification of a social relation.[29] As Marx explains in *Capital*, this view is a product of alienation, wherein the worker is confronted in labor with the means of production, thus viewing these raw materials as the opponent in the labor process.[30] In *Capital* Marx describes machinery in ways that aim to illustrate how the worker experiences this confrontation with the machine as the immediate social relation.[31] I argue that Marx's imagery therefore seeks to represent the fetishism of machinery that results, as Braverman

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28 Useful summaries of the debates that followed Braverman can be found in Harvey (111-19) and Wardell.

29 This is in line with the analysis of Ure's *Philosophy* proposed by Andrew Zimmerman who concludes that "Machinelike workers and the machines which control them by simulating (automating) them—the two great specters that haunt much capitalist mythology, apologetic or otherwise—are the product of no machine, but are rather an ideological mystification of a system of social relations" (24). I disagree with Zimmerman's approach, however, which is heavily invested in proceeding from the point that the "all-encompassing system of industrial manufacture that Babbage and Ure allegedly justified and that Marx took to be real in fact probably did not exist at the time of their apologies" (5). He interprets Ure and Marx as "reconceiv[ing] the mechanical as a political-ontological category prior to historical and economic reality" (7) and thereby denies any real-life counterpart to their representations of industrial machinery and workers' experiences of it, reducing it to "a mechanist ontology" (25).

30 "In this process, then, the *social* characteristics of their labour come to confront the workers so to speak in a *capitalized* form; thus machinery is an instance of the way in which the visible products of labour take on the appearance of its masters" (Marx, "Results" 1055).

31 This is one major source of the critique of both Marx and Braverman. Many critics are troubled that, at these moments in their argument, Marx and Braverman fail to consider that workers may have a better understanding of the class relations behind their encounters with the machine. Both have thus been accused of treating the worker like a thing. While this critique seems appropriate to Braverman, in the case of Marx this assessment fails to consider his intentions in his factory chapters. As Harvey explains, Marx's goal was only to *theorize* what the worker was up against, not to write a *history* of any actual, particular workers' struggles or experiences with machinery (113).

suggests, from attributing to the machine the power and agency that originate in social relations.

Unfortunately, Marx's images of monstrous machinery and human appendages have encouraged many of his readers likewise to fetishize the machine as the worker's enemy, rather than to demystify the ideological nature and function of this perception. Many readers rightly recognize that the monstrous machines are in some way metaphors for the capitalist, but they omit any examination of the connection between machine and capitalist, a problem which leads in these analyses to additional categorizations of Marx's language as rhetorical flourish rather than as crucial elements of his theory.[32] These readers take these metaphors literally and focus their analysis on the human / machine relation they supposedly represent. The problem held in common by these approaches to *Capital* is that they see machines becoming life-like at the expense of the worker. They see a transfer of animation and life between worker and machine, thus following the technologically deterministic perception that there is a relation between man and machine wherein over the course of scientific progress one comes to dominate the other. However, the images of machinery in *Capital* are not just representative of the capitalist in a symbolic or metaphorical sense; these images are meant to reveal machinery as the material form of the capitalist's social relation with the worker. Marx's images of factories overtaken by monstrous automaton / Cyclops / vampire creatures are therefore not simply intended for rhetorical effect. The capitalist's drive to extract maximum surplus value is embedded in the machine, the technology of which enables the capitalist to control the labor process and maximize extraction of surplus value.

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[32] Some representative examples include Ann Cvetkovich, Daniel A. Novak, Elaine Scarry, and Amy E. Wendling.

I turn next to *Capital* to apply the method of ideology critique outlined above. I suggest that analysis of the imagery representing the human / machine relation can disclose the material social relation embedded in the technology, as well as the ideological mystification of this social relation. Moreover, this analysis foregrounds *Capital*'s indebtedness to and conversation with the factory question debates which Marx used as his primary sources for these chapters. Resituating his imagery within the conversation and rhetoric of the texts I examined in the earlier parts of this chapter will shed light on both Marx's monstrous machinery and on the larger nineteenth-century cultural anxiety that workers were turning into machines.

Monstrous Machines in *Capital*

Marx's reliance on Ure's *Philosophy* is well known, and he has been accused of following Ure too closely and accepting some of his propagandistic claims about the factory system as historical fact. While this is at times the case, it is also nonetheless clear that Marx hated Ure and subjected him to some of *Capital*'s most uncompromising abuse. Marx by no means missed the contradiction in Ure's logic described above wherein the factory both frees workers by lightening and relieving their labor and at the same time disciplines them by subjecting them to the machine's controlling movements. He pinpoints the contradiction in Ure's representation of the factory thusly:

> Dr Ure, the Pindar of the automatic factory, describes [the factory], on the one hand, as "combined co-operation of many orders of work people, adult and young, in tending with assiduous skill a system of productive machines continuously impelled by a central power" (the prime mover);

> and on the other hand as "a vast automaton, composed of various mechanical and intellectual organs, acting in uninterrupted concert for the production of a common object, all of them being subordinate to a self-regulated moving force". These two descriptions are far from being identical. In one the combined collective worker appears as the dominant subject, and the mechanical automaton as the object; in the other, the automaton itself is the subject, and the workers are merely conscious organs, co-ordinated with the unconscious organs of the automaton, and together with the latter subordinated to the central moving force. (544-45)

Marx highlights this particular contradiction to reveal a larger problem, which is that Ure constructs a social relationship between the worker and machine. The two apparent choices here—either the worker increasingly gains control over the machine, or the machine increasingly dominates the worker—are products of the ideology of technological determinism described above. In relying on this view that the worker and machine are somehow opponents seeking to dominate each other, Ure's images mask the social relation embedded in technology and portray the relation between worker and capitalist as a negotiation between worker and machine. Marx's intent in *Capital*'s factory chapters is to repurpose Ure's images of workers as "conscious organs, co-ordinated with the unconscious organs of the automaton" so as to reveal the violent, exploitative social relation they obscure. Marx anthropomorphizes the machine to spectacularize this instrument of control and to make vivid the violence of exploitation and the capitalist's drive to control the worker's body.

Marx's revision of the rhetoric from the factory question debates begins with

Capital's chapter 13 on cooperation. He adopts the social body imagery that originates in Kay and is employed by Ure and his pro-industry followers but claims that it is not the machine that unites workers like "organs" in a body. Rather, this unification is the product of the division of labor that characterizes cooperative labor of any sort. In cooperation, workers achieve "unification into one single productive body, and the establishment of a connection between their individual functions" (449). Cooperation creates a collective worker because each individual worker becomes like an organ performing one repetitive function. In this bodily unification the collective worker attains almost monstrous proportions and capacities: "a body of men working together have hands and eyes both in front and behind, and can be said to be to a certain extent omnipresent" (445).

Unlike Kay and the other critics of the factory system, Marx does not attribute the repetitive, monotonous characteristics of labor to its location within the space of the factory or to the introduction of industrial machinery. Rather, it is a product of the division of labor and therefore evident in modes of production prior to the introduction of large-scale industrial machinery. For Marx, the danger of the worker becoming like a machine is nothing new to large-scale industry, nor is it a function of working *with* or *like* machines (as characterized by the ideology of mechanism). In chapter 14 Marx focuses on the manufacture stage when the capitalist brings the workers together in one building so that each portion of the divided labor occurs in unison and with socially imposed demands on time and energy.[33] He explains,

> It is clear that the direct mutual interdependence of the different pieces of

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[33] Marx uses "manufacture" in the literal sense, separating this from the stage of large-scale industry.

> work, and therefore of the workers, compels each one of them to spend on his work no more than the necessary time. This creates a continuity, a uniformity, a regularity, an order, and even an intensity of labour, quite different from that found in an independent handicraft or even in simple co-operation. (465)

This view is quite different from the ideology of mechanism which assumes continuity, uniformity, regularity, and order are characteristics of machines only, not human labor. Moreover, this description rejects the notion that large-scale industrial machinery introduced these machinic and therefore "inhuman" demands on workers and thereby instituted the "mechanization" of the worker, forced to act and work *like* a machine as a result of working *with* a machine. On the contrary, for Marx it is specifically and only through the division of labor that manufacture combines individual workers into "a productive mechanism whose organs are human beings" (457). The mechanization of the worker is therefore a social phenomenon, the product of a social relation which only later becomes embedded in industrial technology through the introduction of the steam engine.

This degradation of labor—which is the central concern of Marx's factory chapters—that follows from the division of labor at the manufacture stage is what makes the worker part of a mechanism. This degradation was emphasized by Braverman as a process of deskilling, and it has received massive attention from the many theorists of the labor process following him. Marx's focus on manufacture highlights the shift away from simple cooperation, wherein the labor is divided and workers cooperate but the worker's productivity, handicraft skill, and life in general are not yet reduced to this singular function. In manufacture, the worker's entire function is reduced to one specific role

assigned in the division of labor: "a worker who performs the same simple operation for the whole of his life converts his body into the automatic, one-sided implement of that operation. . . . The collective worker, who constitutes the living mechanism of manufacture, is made up solely of such one-sided specialized workers" (458). In manufacture, the many-sided functions of their trades are eliminated and the worker thus becomes a mere piece of a mechanism:

> The one-sidedness and even the deficiencies of the specialized individual worker become perfections when he is part of the collective worker. The habit of doing only one thing converts him into an organ which operates with the certainty of a force of nature, while his connection with the whole mechanism compels him to work with the regularity of a machine. (469)

Marx picks up Ure's language of the "organ" but rejects his use which indicates that workers are joined together by a benevolent, healthy, and self-regulating bodily system. Instead, Marx uses the "organ" to indicate the degradation of the worker whose range of capacities are reduced to the singularity and "one-sidedness" of his function in the factory. For Marx, using bodily and machine images together is therefore not mixing metaphors but rather making clear the degradation of the worker in the division of labor, a single organ with a single function. It is this degradation that, for Marx, makes the worker part of a "mechanism" by degrading his range of capacities to a singularity like the "regularity of a machine."

In chapter 15 Marx turns to large-scale industry and continues this revision of Ure's representations of the united, cohesive factory body by making machinery monstrous. Like Ure, Marx sees the factory as coming alive only when the individual

machine is linked to all the other machines which are powered from one central source: the steam engine.

> A system of machinery, whether it is based simply on the co-operation of similar machines, as in weaving, or on a combination of different machines, as in spinning, constitutes itself a vast automaton as soon as it is driven by a self-acting prime mover. . . . An organized system of machines to which motion is communicated by the transmitting mechanism from an automatic centre is the most developed form of production by machinery. Here we have, in place of the isolated machine, a mechanical monster whose body fills whole factories, and whose demonic power, at first hidden by the slow and measured motions of its gigantic members, finally bursts forth in the fast and feverish whirl of its countless organs. (502-03)

Marx adopts the label and definition of "vast automaton" from Ure, but rejects his presentation of the factory as unified, cohesive, and self-protecting. Denying Ure's depiction of the steam engine as the heart of the healthy factory body, Marx pinpoints it as the specific technological innovation crucial to the real subordination of labor under capital because it enables the capitalist's direct control over the labor process. All of the workers and machines assembled together under the stage of mere manufacture become in the stage of large-scale industry linked to the steam engine's central power source.

> [L]arge-scale industry sweeps away by technical means the division of labour characteristic of manufacture, under which each man is bound hand and foot for life to a single specialized operation[;] at the same time, the capitalist form of large-scale industry reproduces this same division of

> labour in a still more monstrous shape[] in the factory proper, by converting the worker into a living appendage of the machine. (614-15)

This turns the factory into a monster by embedding in its structure and technology the exploitative social relation between capitalist and worker while at the same time hastening the development of that social relation. By representing factory machines as monstrous "machines of Cyclopean dimensions" (506), Marx spectacularizes the violence of this social relation as embedded in the technology. Moreover, depicting the machine as a monster represents the ideological mystification of these social relations in the worker's experience of the machine: "Owing to its conversion into an automaton, the instrument of labour confronts the worker during the labour process in the shape of capital, dead labour, which dominates and soaks up living labour power" (548).[34] As a process of alienation, the worker experiences the means of production as a force against himself, a dominating, vampiric monster. Whereas,

> In handicrafts and manufacture, the worker makes use of a tool; in the factory, the machine makes use of him. There the movements of the instrument of labour proceed from him, here it is the movements of the machine that he must follow. In manufacture the workers are the parts of a living mechanism. In the factory we have a lifeless mechanism which is independent of the workers, who are incorporated into it as its living appendages. [Quoting Kay:] "The wearisome routine of endless drudgery

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34 "It is a result of the division of labour in manufacture that the worker is brought face to face with the intellectual potentialities of the material process of production as the property of another and as a power which rules over him. This process of separation starts in simple co-operation, where the capitalist represents to the individual workers the unity and the will of the whole body of social labour. It is developed in manufacture, which mutilates the worker, turning him into a fragment of himself. It is completed in large-scale industry, which makes science a potentiality for production which is distinct from labour and presses it into the service of capital" (*Capital*, 482).

> in which the same mechanical process is ever repeated, is like the torture of Sisyphus; the burden of toil, like the rock, is ever falling back upon the worn-out drudge." (548)

In Marx's system of imagery "life" is bestowed onto the factory to represent workers' alienation when confronted with the means of production as a force dominating them from without. Marx's monstrous imagery is important because it represents the shift in control that produces this alienation. Whereas in handicraft production or simple cooperation the worker (albeit in a relation with capital) still experiences his labor as originating from within, once the machine he works in tandem with is linked to a central motive power controlled by the capitalist this produces the alienation whereby all control and motive becomes experienced as existing outside himself, confronting and dominating him in the form of the machine. This is why, in the absence of all Marxist theory and economic history, writers like Kay and Gaskell immediately recognized the incessant and never-tiring steam engine as the new evil in the emerging factory system. For Marx, Kay's words are therefore distinctly appropriate to describe the alienated experience of being used by a machine like a "living appendage."

CONCLUSION

Marx has been accused of treating the worker like a thing, of not giving the worker credit for any awareness of the real conditions of exploitation, and for failing to attend to the long history of struggle wherein the worker resisted, manipulated, and otherwise avoided the direct control that large-scale industry makes possible. While it was not Marx's purpose to tell this history, *Capital* does make way for the theorization of

this struggle, specifically by revealing the body as a site of class struggle. He writes that the machine

> would go on producing forever, if it did not come up against certain natural limits in the shape of the weak bodies and the strong wills of its human assistants. Because it is capital, the automatic mechanism is endowed, in the person of the capitalist, with consciousness and a will. As capital, therefore, it is animated by the drive to reduce to a minimum the resistance offered by man, that obstinate yet elastic natural barrier. (526-27)

These "weak bodies" are what I turn to in my next chapter where I examine the "obstinate yet elastic natural barrier" of the human body as a site of class struggle. Ure's disciplinary characterization of the factory encourages readers to forget about the actual bodies laboring at the machines. In setting the pace of the machine, the employer was testing this "elastic natural barrier" and calculating the demands that could be placed on the worker's body. In shifting attention away from the demands placed on the body, Ure disappears the laboring body and replaces this site of class struggle with images of harmonious cohesion, discipline, and unity. In foregrounding the ways industrial machines enable direct control over the labor process, Marx shows how the struggle over variable capital is not only a struggle over wages or over the length of the working day, but is primarily a struggle over the production of value via the body's exertion. In my next chapter, I examine the violent damage these factory bodies suffer when "that obstinate yet elastic natural barrier" is broken.

Chapter 2:

"Shew your limbs":

Working-Class Autobiography, Factory Accidents, and the Narrative of Deformity

John Fielden's *The Curse of the Factory System* (1836) was one of the many publications that appeared following the 1832 Parliamentary commissioners' investigations into the working conditions of child factory workers. Though the majority of the book is written as a report on the horrors of the factory system, Fielden breaks with this form halfway through and starts writing in an autobiographical mode, telling the story of his own childhood experiences working in an early industrial factory before he grew up to become a factory owner himself. He turns to autobiography at this moment because it enables him to argue for the Ten Hours movement based on his "own practical bodily experience" (34). He explains that when he was a child, factory work was tolerable because the machines moved at a much slower pace. Since that time, technological advancements have improved machinery to the point that even a ten-hour day has become too much for a child's body to bear: "the labour now undergone in the factories is much greater than it used to be, owing to the greater attention and activity required by the greatly-increased speed which is given to the machinery that the children have to attend to, when we compare it with what it was thirty or forty years ago" (32). Fielden claims that England's rapid technological advancement is actually the "curse of our factory-system: as improvements in machinery have gone on, the avarice of masters has prompted many to exact more labour from their hands than they were fitted by nature to perform" (34).

Fielden's argument is in fact premised on the firm belief that there is a definite, calculable quantity of labour which a child's body is "fitted by nature to perform." Because the ideology of mechanism made it impossible to critique industrial machinery itself, and because his readers would have thought it ludicrous to propose that the children of the poor shouldn't have to work, all that remained for reformers like Fielden was to place an ultimately arbitrary limit on the duration of labor; hence, the Ten Hours Movement. He explains that time is the real problem, not the work: "Who says that five minutes' attendance on a spinning-mule is labour? Nobody. . . . It is the *twelve hours' duration* . . . that makes it exhausting; and, if you will make the inquiry, you will find that, though the damsel of sixteen will dance three, four, or even six hours in a ball-room for one evening, she would not dance for twelve hours together out of the twenty-four hours of the day during one week" (43, original emphasis).

While he is highly critical of factory labor and claims that it turns children into "living machines" (8), in his own analysis of hours worked and energy expended Fielden actually turns the child's body into a mathematical calculation premised on the assumption that all children's bodies operate as predictably, precisely, and efficiently as the machine itself. He devotes several pages to mathematical analysis of the miles walked per day by a child worker who follows and keeps pace with the machine. Having read reports that children at other factories walk between twenty-four and twenty-five miles per day, Fielden resolves to calculate the miles walked in his own factory where, to his pride, he has set the machinery to be driven at a slower than average speed: "To my own surprise, I found that the distance was not less than *twenty miles* in twelve hours" (39-40, original emphasis). Like his analogy of a dancing girl, no one would say that there is

anything wrong with walking in and of itself. But how do we determine how much walking is too much, and at what age does walking twenty miles a day come to constitute humane working conditions? For reformers, answering these questions involves abstracting workers' bodies—of varying ages, genders, and degrees of health—into "the laboring body," an innovation to capitalist economics which, this chapter argues, was made possible by the mechanization of the labor process and which enabled the rationalization of the body as a parallel to the technological rationalization of the industrial factory.

Like Fielden, factory workers generally turned to autobiography as the form specifically suited to their political intention of displaying their mangled and deformed bodies to the middle and upper classes as physical evidence of the inhumane conditions of factory labor. The irreversibly damaged bodies that workers depicted clearly indicate major flaws in the technological design of industrial machinery. However, workers uniformly retreated from using their life stories to launch any broad critique of technology or the factory system, and instead produced graphic descriptions of mangled bodies as evidence in arguments for the reduction of the working day. Their shared purpose was to claim that if the working day was shortened—even by one or two hours—then their bodies would remain exactly as they appeared the day they entered into factory labor: healthy, strong, well-formed, and energetic.[1] The grisly images of bodies becoming increasingly damaged and deformed from working alongside the machines therefore

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[1] The arguments made by the autobiographies examined in this chapter are not unique to working-class articulations of the Ten Hours movement. The industrial novels written by middle-class women, Frances Trollope's *Michael Armstrong, Factory Boy* (1840) and Charlotte Elizabeth Tonna's *Helen Fleetwood* (1841), which I turn to in my next chapter, recapitulate the exact claim proposed by the workers in their autobiographies that, simply by reducing the length of the working day by a couple hours, Parliament could erase the whole cast of physical and moral ills suffered by child factory workers.

seem to exist as evidence in excess of the workers' insistence that they would be healthy and ablebodied enough to do the work demanded if only the working day were one or two hours shorter. The seeming oddity of this argument manifests also in the particular formal structure all of these life stories share in which workers economically structure their life stories as a descent from ablebodiedness to sudden and permanent unemployability.

The seeming incongruence between bodily evidence and political agenda points up the fact that capitalism relies on an abstraction of the body which exists in tension with the real-life bodies produced by the material conditions of their labor and location in relation to capital. Capitalism makes two contradictory demands on the body: it requires the body to be "healthy" enough to perform the work of the day and restore itself to repeat the work the next day; and at the same time it also damages the body, deforming it and pushing it beyond the limit from which it can recuperate. Moreover, this aspect of the autobiographies reveals the fact that the only opportunity that existed for factory workers to engage in class struggle lay in their participation in redefining the capacities of "the laboring body." While these autobiographies deplore the fact that bodies are treated like machine parts to be replaced when worn out, in their arguments for a shortened working day workers by necessity also participated in this very same reduction of their bodies into quantities, wages, and fungible things. This is because their only recourse for class struggle over working conditions was to renegotiate the abstracted laboring body upon which early-nineteenth-century notions of human working conditions were premised.

This chapter begins with David Harvey's intervention into critical discussions on the body through his reassessment of *variable capital*, which has gone largely unheeded

and which I mobilize in developing a historical materialist approach to the body. The second half of the chapter analyzes life stories by factory workers including Robert Blincoe and William Dodd, and models a mode of ideology critique that interrogates the ways capitalist logic resolves the blatant incongruities between the abstracted body of capitalist economics and the lived material body the labor process produces. In their autobiographies, evidence of dangerous machinery was repurposed for use in arguments about time and energy, thus shifting the location of struggle from the technological conditions of workers' injuries, to the renegotiation of the abstracted body as one that can withstand those conditions, if only for a certain number of hours. Making an argument for a shortened working day therefore necessitated that workers participate in the calculation and quantification of "the working-class body," a rationalized way of seeing the body that emerges historically alongside the mechanization of the labor process and the capitalist rationalization of technology. This chapter argues that the introduction of new technologies into the labor process is crucially related to changes in a society's abstraction of the laboring body, the refiguration of this body's defined capacities, and the ideological mystification of real-life bodies' experiences of the labor process.

Part 1: Historical Materialism and the Body

The "bodily turn" has been widely pursued for the past twenty-five years by a variety of disciplines. This focus on "the body" has brought productive attention to embodied subjectivities and the categories of difference that discursively construct bodies. This has been a highly profitable project for those involved, but in the past decade a growing number of materialist scholars (including labor and working-class historians,

feminist historians, and cultural geographers) have all declared a need for a materialist theory that can do more than include class as one of the multiple forms of difference that become "marked" or "written" on "the body."[2] Cultural geographer Reecia Orzeck makes the crucial point that a materialist theory of the body is necessary to move beyond the discursively *constructed* body and toward an alternative understanding of the ways the body is *produced* through the lived effects of the individual's position in the circulation of capital as "Different types of labour transform the body in different ways" (503). She reminds us that "Marx's basic argument is that *every* mode of production—that is, every *social* formation aimed at reproducing itself—produces bodies particular to it. The capitalist mode of production as it existed in Marx's time and place produced the bodies

[2] Feminists in particular have usefully articulated the ways a focus on discursive construction limits access to a material body. Marjorie Levine-Clark finds that "Much of the theory relating to the body tends to deny its physicality, however, focusing instead on its constructed nature. . . . Indeed, only lately have feminists returned to the physical body as a subject of investigation" (6). Kathleen Canning adds: "The search for the 'material' body reflects, in part at least, an unease with the prevalence of the discursive or Foucauldian body" (502). Among the cultural geographers interested in this question, see in particular Felicity J. Callard, Robyn Dowling, and Robyn Longhurst. In 2007 the journal *Labor: Studies in Working-Class History of the Americas* produced a special forum headed by Ava Baron and Eileen Boris's article on "'The Body' as a Useful Category for Working-Class History." Though premised on the desire to explore new productive directions to meet the current needs of working-class history, the options its contributors proposed were nothing new. Baron and Boris are concerned with the bodies that workers bring to the workplace as already sexed, gendered, raced, classed, etc. and the ways this embodiment intersects with the insensitive and discriminatory workplace which regulates, disciplines, and polices that body, and to that end they "seek to incorporate corporeality . . . into understanding the ways discourse operates. Materiality can become a component of representation and discourse" (25-26). While Baron and Boris acknowledge that bodies "have been a site of struggle among workers and between workers and their bosses, manifested in conflicts over the labor process, over the choreography of bodily movements, and over control of the pace of work and the length of the workday," they resist analysis of the economics of these real-life bodily experiences (41). In an article appearing in the same year, Joan Sangster complains that feminist historians "completely neglect wage labour," citing the fact that "scholars both inside and outside working-class history see 'old-fashioned' approaches emanating from historical materialism as too deterministic or economistic for this recuperation project" (245, 268). Sangster follows Rosemary Hennessey in finding "a 'kernel' of materialist insight worth preserving . . . in the concept of surplus value: in the last resort, this inevitable expropriation of labour from workers' bodies is a driving force of capitalism," yet the article's historical case study does not offer a model for this kind of economic analysis (268-69). Sangster assumes that postmodernism forecloses attention to wage labor: "If bodies are recognized only within an abstract circle of discourse, will we not lose our connection to a politics of social transformation that understands that the oppression, maiming, and utilization of bodies is facilitated by a particular set of social relations, economic structures, and forms of injustice?" (246). While Sangster and Orzeck proceed by critiquing the limitations of post-structuralism, I would rather question the materialist scholars themselves who demand a materialist approach to the body but ignore economic analysis as a foregone conclusion.

he describes in the pages of *Capital*. A different mode of production would, according to historical materialism, produce different bodies" (500, original emphases). In *Capital, vol. 1* Marx presents two interrelated ways that the economics of a particular labor process affects the production of bodies: the length of the working day and the wage rate. Through the labor of the working day "a definite quantity of human muscle, nerve, brain, etc. is expended, and these things have to be replaced. . . . If the owner of labour-power works today, tomorrow he must again be able to repeat the same process in the same conditions as regards health and strength. His means of subsistence must therefore be sufficient to maintain him in his normal state as a working individual" (274-75). The capitalist therefore pays the laborer only for his "necessary labor time"—"necessary" because the wage rate is the minimum amount that will allow the worker to reproduce himself as able to work again the next day: "The capital given in return for labour-power is converted into means of subsistence which have to be consumed to reproduce the muscles, nerves, bones and brains of existing workers, and to bring new workers into existence" (717).

Workers are therefore produced through the labor extracted and the wages given to restore the body, factors which Marx explains have moral and physical limits: "by means of the price you pay for [my labor power] every day, I must be able to reproduce it every day, thus allowing myself to sell it again. Apart from natural deterioration through age etc., I must be able to work tomorrow with the same normal amount of strength, health and freshness as today" (343). In addition to manipulation of the wage rate, the working day may be extended beyond the length at which it is possible for the worker to recover: "Within the twenty-four hours of the natural day a man can only expend a

certain quantity of his vital force. Similarly, a horse can work regularly for only eight hours a day. During part of the day the vital force must rest, sleep; during another part the man has to satisfy other physical needs, to feed, wash and clothe himself" (341). However, despite the moral and physical limits to the working day and requirements for the wage rate,

> in its blind and measureless drive, its insatiable appetite for surplus labour, capital oversteps not only the moral but even the merely physical limits of the working day. It usurps the time for growth, development and healthy maintenance of the body. . . . It reduces the sound sleep needed for the restoration, renewal and refreshment of the vital forces to the exact amount of torpor essential to the revival of an absolutely exhausted organism. (375-76).

Capital's disregard for the moral and physical limits of the working day is only part of the reason why the investment the capitalist makes in wages is categorized as *variable capital*. Unlike constant capital (investment in assets like buildings), the capitalist's return on his investment in wages varies according to each individual worker's capacity to exert labor power and ability to struggle against and resist the demands of the labor process.

In *Spaces of Hope* David Harvey makes a highly suggestive intervention into debates on "the body," declaring, "Marx's distinction between the laborer (*qua* person, body, will) and labor power (that which is extracted from the body of the laborer as a commodity) immediately provides an opening for radical critique" (102). He argues that analysis of variable capital provides the crucial link between the body and the economic

category of labor power as both produced through processes of struggle:

> [The] preservation of the integrity and fullness of the laboring person and body within the circulation process of variable capital is the fulcrum upon which contestation and class struggle both within and without the labor process occurs. Even bourgeois legality (as incorporated in the Factory Acts then and in, say, Occupational Safety and Health Administration regulations now) has to concede the difference between the right to the commodity labor power and the nonright to the person who is bearer of that commodity. This struggle carries over into the determination of the value of variable capital itself, because here the "neediness" of the body of the laborer forms the datum upon which conditions of contract depend. In *Capital* Marx, for purposes of analysis, presumes that in a given place and time such needs are fixed and known (only in this way can he get a clear fix upon how capital is produced through surplus value extraction). But Marx well understood that these conditions are never fixed but depend on physical circumstances (for example, climate), cultural and social conditions, the long history of class struggle over what is a livable wage for the laborer, as well as upon a moral conception as to what is or is not tolerable in a civilized society. (107)

Harvey's point is that "the 'neediness' of the body" is not fixed but is calculated through these processes of struggle over the labor process. Because capital would push the moral and physical limits of the needs and capacities of the worker's body, society must impose limits and does so by defining culturally acceptable working conditions. All of these

components are determined through interrelated processes of struggle and in relation to cultural conceptions of what the labor process can demand of bodies of particular ages, genders, races, etc. These definitions of the needs of the body and of the body's capacity to labor comprise the abstraction of "the laboring body" upon which are premised the economics of the buying and selling of labor power. In this way capitalist logic and practice equalizes human bodies, reducing them to an abstraction able to labor and reproduce itself as the labor process demands. I suggest that, when Marx presumes that needs and capacities are fixed and constant, he does not simply employ the concept of an "average worker" to simplify matters for the sake of his argument, but rather shows how the economic conditions he describes are themselves premised on an "average worker": "We assume throughout, not only that the value of an average labour-power is constant, but that the workers employed by a capitalist are reduced to average workers" (418). The conception of an "average" body is employed by Marx because it is socially constructed through the economic determination of needs and capacities and thereby impacts the demands placed on the real-life bodies that labor. The needs and capacities of the body are defined as economic abstractions and become imposed upon individual real-life bodies through the demands of the labor process. Struggles over the wage rate, working conditions, and length of the working day are premised on the re-negotiation of what this abstraction—all bodies, *the* body—requires and can endure.

Harvey goes on to point out that "the exigencies of capitalist production push the limits of the working body—its capacities and possibilities—in a variety of different and often fundamentally contradictory ways. . . . Healthy bodies may be needed but deformities, pathologies, sickness are often produced" (103). While capital demands that

workers reproduce themselves as able to work again the next day, the labor process inevitably damages bodies in ways that wages in any amount could never recover. As Orzeck describes,

> Workers lose limbs, digits, fingernails, eyes; they develop repetitive strain injuries, respiratory diseases, skin diseases, diseases from exposure to asbestos, pesticides, and other hazardous substances. Equally material are the transformations of the body that take place beyond the workplace which owe their existence not to a type of work but to a worker's location within the nexus of social relations . . . . Labour and social relations can produce . . . an irreversibly harmed body: out of the body flexible enough to wrestle machinery on the factory floor emerges the body with nine fingers; out of a changeable body capable of being now obese now emaciated emerges the body that will never shed its relationship to diabetes, as well as the body that can never recover from delayed neurological development. (503)

Orzeck's examples foreground the glaring discrepancies between the abstracted body capitalist economics assumes and the individual bodies labor produces. I suggest that ideologies about "the body" work to coordinate and resolve tensions between the material production of the body described by Orzeck and the economic abstraction of the body defined by consistent, calculable needs and capacities. Through these ideological resolutions, capitalist logic makes a non-issue of the fact that labor damages the body and diminishes its capacity while still constructing it as the abstracted body containing the consistent capacity the labor process demands.

Harvey explains that historical changes in the mode of production result in struggles over and renegotiation of the abstraction of the body because

> part of what the creative history of capitalism has been about is discovering new ways (and potentialities) in which the human body can be put to use as the bearer of the capacity to labor. . . . Older capacities of the human body are reinvented, new capacities revealed. The development of capitalist production entails a radical transformation in what the working body is about. The unfinished project of the human body is pushed in a particular set of contradictory directions. And a whole host of sciences for engineering and exploring the limits of the human body as a productive machine, as a fluid organism, has been established to explore these possibilities. (104)

The "host of sciences" to which Harvey refers are only the most formal of the methods by which the capacities of the abstracted body are culturally redefined in order to make acceptable the ways technological changes to the labor process impose new demands and wreak new damage on individual bodies. A historical materialist approach to the body therefore must attend to the ways technological developments in the mode of production and the new experiences of bodies in the labor process result in struggles over the material conditions of the labor process *as well as* renegotiation of the abstracted body defined as one able to meet the demands of that labor process.

In addition, this "host of sciences" is one of the ways capitalist cultures naturalize the treatment of "the human body as a productive machine" (104). As Marx explains, "food is added to the worker as to a mere means of production, as coal is supplied to the

boiler, and grease and oil to the machinery" (375). When the working day is extended, "the forces used up have to be replaced more rapidly, and it will be more expensive to reproduce labour-power, just as in the case of a machine, where the part of its value that has to be reproduced daily grows greater the more rapidly the machine is worn out" (377). I argue that the economic abstraction of the laboring body historically emerged specifically out of struggles over early-nineteenth-century industrial technology *and* that this view of the body as a machine that Harvey describes is rooted in these particular historical technological developments. As explained in chapter 1, innovations in the labor process introduced the technological means for the capitalist to make demands on the body through direct control of the labor process. Because the capitalist was newly able to control the speed, intensity, and times of mechanized labor, the body's capacity to labor came to be defined by the technological demands imposed by the capitalist in the labor process. The inelastic demands of machine production therefore constitute the fundamental development in the mode of production that resulted in the abstracted body of capitalist logic—that is, the body that can work at whatever speed and with whatever rhythms and for whatever duration the machine (i.e. the capitalist) demands.

Historical materialist analysis of the body thus connects the physical and social production of bodies. Cultural conceptions of what is morally tolerable in a given society cannot be analyzed in the absence of consideration of the technological conditions of the labor process, as these conditions define the abstracted body upon which society premises its debates about human rights and its conceptions of human potentials. As revealed in the autobiographies which I turn to in the second half of the chapter, this abstracted body is the necessary subject called up in legislative struggles over working conditions, the

length of the working day, and minimum age requirements for workers. These debates relied on the assumption that the capacities and "neediness" of the human body can be precisely calculated and legislated by Parliament, and in order to contribute to these debates workers had to participate in renegotiating the construction of this abstraction. For early-nineteenth-century workers, the stakes were high: this abstracted body not only determined the rate of wages for what a working-class body needs to reproduce itself, but also determined how many hours a twelve-year-old "adult" can continuously labor, how many cubic feet of space supply the body with adequate oxygen, and how frequently young children need to urinate.

Cultural conceptions of what is morally tolerable in a given society are thus shaped in relation to the technological demands of the labor process which define the abstracted body upon which society premises many of its conceptions of human potentials and debates about human rights. Analysis of the production of the body in the labor process is therefore a necessary part of the tasks set out by recent critical theories of technology. In particular, Andrew Feenberg's proposals for critical theory have been extremely stimulating in their aim of critiquing the formal bias and rationalization embedded in technology; uncovering and analyzing the interests and social hierarchies embedded in technical codes; and the ultimate goal of democratizing the process of technological design. I argue that these tasks laid out by Feenberg are incomplete without analysis of the relation between technological development and the renegotiation of the body as an abstraction. Feenberg himself emphasizes the inextricability of cultural values and technological advancement:

> Ethical discourse and ethical demands are often provoked by the

> limitations of existing technical codes. For example, where safety is not adequately protected by existing product standards, the value of life is brought forward as an ethical claim that advocates attempt to impose on manufacturers. The successful imposition of this claim by law or regulation transforms it from an ethical demand into a technical code and results in the ethical issue sinking beneath the surface in a kind of technological unconscious. Often current technical methods or standards were once discursively formulated as values and at some time in the past translated into technical codes we take for granted today. (21)

I propose that critical theories of technology are incomplete without consideration of the ways bodies are produced by the lived experience of the labor process and the ways technological rationalization produces the economic abstraction of the laboring body as defined by the demands of the labor process. In its ultimate goal of democratizing technology, I suggest critical theory must engage more fully with the ways existing technological design structures the terms of class struggle which necessarily must renegotiate the abstraction of the working body in order to achieve changes to working conditions. Critique of technology therefore requires analysis of the bodies technology produces, and I hope the historical materialist approach modeled in this chapter is suggestive of possibilities for this task.

Part 2: Autobiographical Form and the Reform Agenda

In the next half of this chapter I examine workers' autobiographical accounts of factory accidents, bodily damage, and deformity. I here consider a variety of textual

forms as "autobiographical," grouping together autobiography, memoir, interviews, and official testimony given before Parliament, in order to gain access to the full range of available means through which usually uneducated and often illiterate workers were able to construct their life stories and represent their bodies.[3] *A Memoir of Robert Blincoe* (1832), for example, was written for Blincoe by John Brown, a middle-class journalist who composed the memoir based on what Blincoe told him in conversation. More strictly conforming to traditional definitions of autobiography is William Dodd's *A Narrative of the Experience and Sufferings of William Dodd, a Factory Cripple, Written by Himself* (1841).[4] I read these alongside the testimony given by workers called to appear before Parliament during Factory Commissioners' investigations in the 1830s, and I also include the life stories workers produced in interviews Dodd conducted to collect additional evidence for these Parliamentary debates.[5] Dodd's and Blincoe's texts are by no means unknown and, like the more historically significant Parliamentary records, are regularly

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[3] By the 1830s and '40s working-class autobiography was an established practice with a ready audience. David Vincent's *Bread, Knowledge and Freedom* uncovers 142 autobiographies by nineteenth-century British workers, and his bibliography *The Autobiography of the Working Class* contains entries on over 1,000 autobiographies by British workers from the 18th to the early 20th century. Lee states "the persistent presence of 'low' autobiography in the literary marketplace confirms the voracity of readers for the lives of the obscure and the ignoble" (2).

[4] In this chapter I focus only on men's autobiographical accounts. As most historians of working-class autobiography note, it is unfortunate that so few autobiographies by nineteenth-century women exist. A notable exception to this rule are the autobiographies by "factory girl" Ellen Johnston whose efforts are anomalous in that they are part of her aspiration to a literary career, and thus not written for the distinctly pragmatic and political purpose that gives shape to the working-class autobiographies considered here. The autobiographies I examine in this chapter do not allow for any substantive consideration of gender because they describe primarily child labor, during which boys and girls labored together and were legally and socially treated much the same.

[5] Women did give testimony before Parliament, but in this public venue were obviously not able to describe their bodies in gendered terms. The only real access we have to gendered experiences of factory labor are from the perspective of higher-classed constructions of gender imposed onto women by, for example, the Parliamentary investigators during interviews. Marjorie Levine-Clark finds that, in contradiction to these constructions imposed by the investigators, working-class women in their testimony revealed a perception of their laboring bodies that shared more in common with how men perceived their bodies through an economic perception of ablebodiedness. See also Hamilton's "Images of Femininity in the Royal Commissions of the 1830s and 1840s."

mentioned in histories of industrial England.[6] However, the numerous graphic descriptions of accidents and disfigured bodies that this range of texts all produced have not yet received close textual analysis, either from scholars of legislative or industrial history or from literary scholars of the Victorian era.[7]

Dodd's and Blincoe's texts have also not been studied within this broader range of autobiographical forms, an approach which is truer to the early-nineteenth-century perception of life-writing. The genre "autobiography" was newly named in the early decades of the century, and because the term was used to refer to content, it covered a remarkably diverse range of textual forms. For example, the brief interviews with street people that Henry Mayhew collected in his *London Labour and the London Poor* were advertised as "autobiographies." Accordingly, literary scholars including David Vincent, Felicity Nussbaum, and Regenia Gagnier have argued against the practice of projecting definitions of autobiography produced by mid-twentieth century literary critics onto historical texts because "such definitions can only be used to demonstrate the ways in which [earlier] texts fail to measure up to [our] generic expectations" (Nussbaum 4).[8] These scholars also reject the assumption that nineteenth-century working-class

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[6] Major studies of child labor in industrial England include Humphries, Nardinelli.

[7] Critics like Mike Sanders give Blincoe's *Memoir* and Dodd's *Narrative* little attention, claiming that working-class autobiographies actually reveal more about the political agendas and readerly desires of the higher-classed readers for whom they were produced than the perspectives of its working-class subjects (316).[7] Contra this assessment, I argue that the fact that these accounts were shaped entirely by their reform agendas and the intention of appealing to higher-classed audiences in fact comprises the pragmatic function that unites the genre. Blincoe's text has received some limited notice as a source for Dickens's *Oliver Twist* and Trollope's *Michael Armstrong*. Dodd is often mentioned in studies of working-class autobiography. While nineteenth-century factory accidents are studied, workers' descriptions of the accidents and their long-term bodily results are given a subordinate role to legislation of working conditions, worker's compensation, and "the accident" as a cultural concept. See Gagnier, Bronstein, and the collection edited by Cooter and Luckin.

[8] Nussbaum describes our current "prescriptive definitions of the genre of autobiography": "the formal aspects of the genre have been frequently codified as narrative with a beginning, middle, and end which purports to be true, is told retrospectively, and whose author is the same historical being as the first-person narrator and protagonist" (4).

autobiographers were imitating or aspiring to participate in bourgeois traditions and autobiographical forms. Just as problematic as using twentieth-century definitions of genre to evaluate nineteenth-century texts, viewing working-class autobiographies as failed attempts at the form likewise forecloses analysis and imposes artificial restrictions on the archive.[9] Instead of evaluating these autobiographical accounts by their adherence to an ahistorical and classist definition of genre, I follow Gagnier who focuses on the pragmatism of autobiography and "seeks to locate the purpose an autobiographical statement serves in the life and circumstances of its author and readers" (4). This pragmatic approach is especially relevant to working-class autobiographical statements which were entirely politically motivated and, through a variety of forms, allowed workers to circumvent the illiteracy, lack of education, and lack of free time and energy which excluded them from traditional endeavors at life-writing.

The autobiographical accounts considered in this chapter all share the same pragmatic purpose: to expose the horrors of child labor and argue for specific reforms to the factory system, primarily the Ten Hours Bills considered before Parliament during the 1830s and 1840s. The ten-hour day they agitated for would limit the labor of children and women to ten hours Monday-Friday and an eight-hour "half-holiday" on Saturday.[10]

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9 Vincent rejects the suggestion that "working-class autobiographers were consciously imitating a borrowed form of self-expression" (4).

10 Robert Peel's 1802 Act for the Preservation of the Health and Morals of Apprentices covered only apprentices, limiting their days to 12 hours but setting no age restrictions; by 1804 apprentices were also prohibited from working at night (9:00pm-6:00am). The Regulation of Cotton Mills and Factories Act of 1819 extended these provisions to all children ages 9-15 and prohibited the employment of younger children. The 1833 Act to Regulate the Labour of Children and Young Persons in the Mills and Factories extended factory legislation to cover additional industries, limited the hours of children ages 9-12 to 9 hours a day (a 48-hour week), and prohibited children under 18 from working more than 12 hours a day (a 69-hour week) and from working at night (8:30pm-5:30am). The Ten Hours movement of the 1830s and '40s sought to reduce this 12-hour day for women and children, which would in effect mean a 10-hour day for adult men as well since the factory could not continue to operate after the bulk of its workforce had gone home. Despite the new factory inspectors appointed by the 1833 Act, age and time restrictions

Central issues debated in these decades included age restrictions which, for example, deemed thirteen-year-olds "adults" capable of working a twelve-hour day (a seventy-two-hour week). As one historian remarks, "Conditions that we would consider simply beyond the physical endurance of young children were exactly those that the reformers were trying to have mandated for them" (Carlisle 42-43). Workers agitated in a number of ways in support of the Ten Hours movement by signing petitions, staging marches, and sending representatives to lobby members of Parliament. However, it was by giving testimony before Parliament that they could most directly be seen and heard. During the debates and inquiries of the 1830s, dozens of workers were paraded before Parliament, interviewed, and asked to "shew your limbs to the gentlemen," displaying their damaged bodies as evidence verifying their testimonies. The testimony of one such worker, Charles Aberdeen, reveals the clear connection many workers saw between the answers given to interviewers' questions and the more complete life story they would construct if they were able: "If I was in solitary confinement I could write a history of my life, and I could show up the factory system then" (qtd. in Grey 70). Aberdeen believes that autobiography is the most effective potential means of gaining political change, demonstrating the crucial link workers saw between their life stories and the genre's pragmatic ends.[11]

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remained largely unenforceable. Despite regulations against nightwork, many factories operated in shifts so the machines never had to stop. Age restrictions were also easily avoided: Parliamentary testimony shows that most children were unsure of their age, and reform literature depicts the medical men (sent to determine children's ages by looking at them) as grossly incompetent if not actually corrupt. See Gray and Carlisle.

11 Carlisle also finds that "autobiographies written by workers in the first half of the century found a major impetus in their necessarily preeminent concern with the political life from which they were formally—but only formally—excluded. . . . Written not only to address but also to alter the course of historical events, working-class autobiographies in the nineteenth century provided effective ways of engaging in public debate" (13-14).

The factory workers agitating for the Ten Hours cause moreover conceived of autobiographical statements as extending practices of legal testimony and bodily display.[12] Dodd's *Narrative* is dedicated to Lord Ashley, the primary advocate of the Ten Hours cause who used Dodd's texts in Parliamentary debates.[13] A year later Dodd published *The Factory System Illustrated; in a Series of Letters to Lord Ashley* which reproduced his interviews with factory workers in the speakers' own words, each as a miniature autobiography. He was never able to appear before Parliament, so Ashley described Dodd's body to verify his textual evidence: "Certainly I never saw a more wretched object. He had lost his hand, and I may say he had almost lost his shape. He hardly looked indeed like a human being" (qtd. in Carlisle 12). Blincoe's *Memoir* similarly foregrounds the important role of bodily display in workers' evidence, beginning with its title page where an image of Blincoe's crooked legs invites the reader into the book to learn the story of the life that resulted in this deformity. A year later Blincoe appeared before Parliament and testified that he had to leave work in the factories because "I got deformed there; my knees began to bend in when I was fifteen; you see how they are (*showing them*)," and advised his audience to read his book for an

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12 There is also evidence that workers' testimonies were consumed as autobiography by middle-class readers. Charles Wing's *Evils of the Factory System Demonstrated by Parliamentary Evidence* (1837) reproduced hundreds of pages of blue book documents including speeches, debates, and abridged selections of testimony delivered by factory workers, medical men, factory owners and overseers. Samuel H. G. Kydd's *The History of the Factory Movement from the Year 1802, to the Enactment of the Ten Hours' Bill in 1847* transforms workers' testimony into narratives, creating the impression that the information was not directed and shaped by official questions, but rather that it proceeds directly from the workers' own ideas of how to tell their life stories.

13 The testimonies given by factory workers were being taken seriously in Parliament, as evidenced by the scandal that ensued when attacks on Dodd's character were used to discredit Ashley's argument for the Ten Hours Bill. Dodd was accused of being a trickster who produced contradictory representations of the factory system and tried to sell them to both sides of the Ten Hours debate. Dodd's legacy has been unable to shake this accusation, and it continues to prevent some historians and literary critics from granting his writings any close attention. Blincoe's *Memoir* is likewise often dismissed because it was written for him by John Brown, a middle-class journalist who composed the text based on conversations with Blincoe.

extended explanation of his deformities (qtd. in Carlisle 46).[14]

In these political struggles over the conditions of factory labor, workers endeavored to renegotiate the abstraction of the body upon which working conditions were premised, primarily by arguing that the length of the working day unnaturally extended labor beyond the working-class body's inherent capacity.[15] This abstracted working-class body was defined by an assumed ablebodiedness, capacity, and ability to labor consistently as the machine demands. Accordingly, in workers' autobiographies, conceptions of ability and ablebodiedness are constructed in relation to the demands of the labor process, and incapacity and failed ablebodiedness are defined as the final moment of inability to return to the machine.[16] Marjorie Levine-Clark and James Riley confirm that nineteenth-century workers perceived their health in terms of their employability. In their respective studies of working-class women and men they show that, for the workers, "being able to work was equated with being able-bodied" and that ablebodiedness "meant being able to continue working, even if this [labor] conflicted with their physical well-being" (Levine-Clark 60, 175). In the autobiographies considered here, deformity, disfigurement, and poor health are constantly defined by the individual's inability to return to work in the factory.[17] Blincoe's *Memoir*, for example, reveals that

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[14] Blincoe also appeared at Factory Movement meetings in order to display his deformities and scars to authenticate the written account. See Musson for fuller account of Blincoe's life and political activities.

[15] These workers could not, for example, complain that they did not want to work in the factories at all; nor could they demand that the machines operate more slowly or with less intensity because that would require the capitalist to negotiate his profits. Instead, they had to accept the demands of the labor process as the requirements of the reified machine and present themselves as willing and able to work as hard as the machine demanded.

[16] David Harvey in *Spaces of Hope* argues that, in addition to this being a historically specific perspective, within the capitalist circulation of variable capital generally "sickness (or any kind of pathology) gets defined within this circulation process as inability to go to work" (106).

[17] Deborah Stone's foundational work in disability studies similarly theorizes how in the modern welfare state the category of "disability" defines productivity by symbolizing its opposite. Sarah F. Rose

even small children were treated as fit to labor based on the fact that they were still laboring: "none were considered sick, till it was found impossible, by menaces or by corporeal punishment, to keep them to their work" (136). Blincoe goes on to explain that, when these children's bodies become "worn out" and are finally unable to work, they are disposed of like pieces of broken equipment: "they were worked to the very last moment it was possible for them to work; and when it was no longer possible, if they dropped down, they were put into a wheel-barrow" (137).

A particularly striking instance of this definition of health and ablebodiedness as defined through labor is given by Blincoe as an anecdote in his *Memoir*:

> A girl, named Mary Richards, who was thought remarkably handsome when she left the workhouse, and who might be nearly or quite ten years of age, attended a drawing frame, below which, and about a foot from the floor, was a horizontal shaft, by which the frames above were turned. It happened, one evening, when most of her comrades had left the mill, and as she was taking off the weights, her apron was caught by the shaft. In an instant the poor girl was drawn by an irresistible force and dashed onto the floor. She uttered the most heart rending shrieks! Blincoe ran towards her, an agonized and helpless beholder of a scene of horror that exceeds the power of my pen to delineate! He saw her whirled round and round with the shaft—he heard the bones of her arms, legs, thighs, &c. successively snap asunder, crushed, seemingly, to atoms, as the machinery whirled her round, and drew tighter and tighter her body within the works, her blood

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has more recently developed connections between theoretical work in disability studies and her examinations of the experiences of injured workers within the field of working-class history.

> was scattered over the frame and streamed upon the floor, her head appeared dashed to pieces—at last, her mangled body was jammed in so fast, between the shafts and the floor, that the water being low and the wheels off the gear, it stopped the main shaft! When she was extricated, every bone was found broken!—her head dreadfully crushed!—her clothes and mangled flesh were, apparently inextricably mixed together, and she was carried off, as supposed, quite lifeless. "I cannot describe," said Blincoe, "my sensations at this appalling scene. I shouted out aloud for them to stop the wheels! When I saw her blood thrown about like the water from a twirled mop, I fainted. But neither the spine of her back was broken, nor were her brains injured, and to the amazement of every one, who beheld her mangled and horrible state, by the skill of the surgeon, and the excellence of her constitution, she was saved!" (123)

It astonishes the reader that after spewing blood like "water from a twirled mop," ten-year-old Mary's body can be made whole again. Even though her flesh was so mangled that "she was carried off, as supposed, quite lifeless," in the end it is her "excellent [i.e. working-class] constitution" that kept her body "safe" from damage. A life of factory labor produced for Mary a body so healthy that she can withstand any damage and return to work again, and her resilience denies that industrial labor itself is the problem by demonstrating the consistently "excellent constitution" of a factory worker's body.

This conception of ablebodiedness as defined by employability results in the particular formal structure common to these texts which I call the narrative of deformity. Unable to experience the domestic, religious, and educational events that structure a

middle-class life and thus produce the form of bourgeois autobiography, factory workers produced life stories structured instead by economic descent from ablebodiedness to unemployability.[18] This decline is not marked by the appearance of pain, the gradual failure of individual bodily parts, or the increasing difficulty of particular activities (walking, eating, standing upright). Rather, because ablebodiedness is defined by the ability to earn full wages, working-class lives are punctuated by deformity and/or loss of body parts as economic events resulting in wage reductions, forced time off, and eventual forced retirement. In the narrative trajectory of Dodd's *Narrative*, for example, "year after year passed away, my afflictions and deformities increasing" (192). With the inability to work as the defining event marking a body's unhealth, failed capacity, and bodily damage, factory workers' life stories are formally structured around the events that lead up to this ultimate bodily and economic failure.[19]

The predictable narrative of deformity that these life stories follow begins when the small child enters the factory healthy, energetic, and well-formed. Before Dodd began working he was "a fine, strong, healthy, hardy boy, straight in every limb, and remarkably stout and active" (187). The main events of every story are incidents of injury or deformity, and the narrative concludes when the individual is eventually unemployable. Forced to leave the factory, the worker is always shorter than he should

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18 While the conception of autobiography developed decades ago by Pascal assumes that "All life stories, but particularly those of the upwardly mobile, are recounted from the vantage point of attainments and interpreted through a teleological lens" (Humphries 21), rather than being structured by a upward structure of achievement and attainment, these working-class autobiographies exhibit a reversal of this form.

19 W. S. Howard similarly shows that the autobiographies of miners have common structures, preoccupations, styles and motivations, which cast light on their specific occupational community, but he agrees with Vincent in preferring to treat them as literary texts: "It is not by adding, subtracting or dividing that we can learn from texts" but by the identification of common literary characteristics that reveal occupational solidarities and shared ideals (92).

be, crooked, deformed, and/or missing one or more appendages. The narrative's conclusion does not come with the healing of the body or removal of painful labor, but with the individual's decline into permanent financial destitution. Unemployment is both the measure of a deformed body and the generic conclusion to workers' life stories. This unemployable body is always contrasted with the body that would have developed if not for factory labor, evidence of which is supplied by recollections of childhood physical aptitude or comparison to parents or siblings who never worked in the factories. Dodd explains that when he was a small child "It was predicted by many of our acquaintance that I should be the very model of my father, who was the picture of robust health and strength, and, in his time, had been the don of the village, and had carried off the prize at almost every manly sport" (187). Dodd further demonstrates his childhood capacity by recalling that when he was five or six years old an exciting event caused him to run all the way home; however, years of factory labor made him unable to ever repeat this act:

> I was put into the factories soon after, and have never been able to perform this feat of running three-quarters of a mile since. From six to fourteen years of age, I went through a series of uninterrupted, unmitigated suffering, such as very rarely falls to the lot of mortals so early in life, except to those situated as I was, and such as I could not have withstood, had I not been strong, and of a good constitution. (187)

Dodd's "good constitution" is evidence of how his body was intended to develop: a picture of working-class ablebodiedness, capable of performing the rigorous labor for which it was designed by nature. Dodd bitterly laments that he has been robbed of this physical destiny, and offers his deformed body as proof that there is a problem, not with

hard work itself, but with the particular conditions of labor forced upon factory workers.

These narratives of deformity end with their subject's inability to resume labor, the final mark of their deformity. Blincoe's *Memoir* ends with his removal from industrial employment and consequent unemployability. He seeks work at several other factories, but as a result of his deformity is always paid reduced wages (168). He finally gives up seeking full wages, and his story concludes with him suspended in a state of perpetual unemployment as a confirmed "cripple." Dodd's story similarly leads up to the conclusion promised by its title when he becomes a "factory cripple," defined by the fact that he is no longer able to work in the factory and eventually, after the amputation of his right arm, is unemployable in any profession. His story ends with the lament that he could not do the work for which his body was intended: "Think not, dear reader, that I have here drawn an exaggerated picture of a factory life:—it would be well for me if it could be proved that I am wrong—if, instead of being a miserable cripple, scarcely the shadow of a man, it could be proved that I am straight, strong, and hardy as when I entered the factories" (221). This is the last we hear of Dodd's employment history and, like Blincoe, his life story ends with him suspended in a state of perpetual unemployment. We can only speculate how, without his right arm, Dodd went on to write the *Narrative* he has just concluded.

In addition to long-term health problems like Dodd's arm, these autobiographies include numerous graphic accounts of industrial accidents that maimed and killed factory workers. One man Dodd interviewed for *The Factory System* tells him,

> I commenced working in a cotton factory at eight years of age, and continued to follow the same occupation until I met with an awful

> accident, by which I lost *both arms*. . . . Whilst I was holding the strap, it gave a twitch, and in an instant my whole body was coiled round the shaft; and in this manner I was carried round for the space of a minute. When the engine was stopped, I was suspended *by the flesh of my right arm*, the other was completely torn from my body. I recovered and am now depending on my parents for support. (75, original emphases)

In accounts of factory accidents like this one, the machine is routinely described as horrific, dangerous, and out of control, and each story is followed by the teller's demand that some minimal barriers be installed to protect workers' bodies from the machines. However, these gruesome descriptions existed in excess of the political function and formal structure that unite workers' autobiographies. While revealing clear flaws in technological design, workers' life stories also, through bizarre rhetorical maneuvers, shifted the import of these stories of tragic accidents, repurposing them in the service of their arguments for the Ten Hours movement.

These autobiographies all begin by claiming that bodies were deformed by the *form* and *kind* of labor, before then shifting their focus to claim that only the extreme duration makes this labor problematic. Forcing workers to stoop and bend their bodies to meet the machines' dimensions in effect keeps them always child-sized, and Blincoe and Dodd provide detailed descriptions of the machines in order to pinpoint these clear design flaws. When Blincoe gave testimony before Parliament in 1833 he was asked if he would send his own children to work in the factories and replied, "No; I would rather have them transported. In the first place, they are standing upon one leg, lifting up one knee, a great part of the day, keeping the ends up from the spindle; I consider that employment makes

many cripples" (qtd. in Carlisle 329). Dodd also goes to great lengths in his *Narrative* to present an educated and scientific analysis of how extended periods of standing cause the weight of the body to put undue pressures on the bones of the feet and spine. He writes:

> The position in which the piecer stands to his work is with his right foot forward, and his right side facing the frame: the motion he makes in going along in front of the frame, for the purpose of piecing, is neither forwards nor backwards, but in a sidling direction, constantly keeping his right side towards the frame. In this position he continues during the day, with his hands, feet, and eyes constantly in motion. It will be easily seen that the chief weight of his body rests upon his right knee, with is almost always the first joint to give way. The number of cripples with the right knee in greatly exceeds those with the left knee in; a great many have both knees in—such as my own—from this cause. (190)

The Parliamentary investigators also endeavored to elicit workers' testimony that would make this point, and repeatedly asked workers if they were forced to manipulate their bodies into "constrained attitudes" to match the shapes, movements, and speeds demanded by the machines. Saunders Crabb became so misshapen that he was not able to attend Parliament to give his own testimony: "He has the form of the letter Z; his body is twisted in one direction, and his shoulders in another; the body is twisted backwards and forwards, and his legs are so bowed that he mostly sits upon his heels" (qtd. in Wing 33).

Despite the specificity of these explanations for particular deformities, in both Parliamentary investigations and in workers' autobiographies deformed bodies are used as evidence in arguments for a shortened working day. The argument was never made

that children's bodies cannot sustain the physical labor that the machines demand, but instead that the working-class body was only capable of such labor for a maximum of ten hours. They tried to show that the greater number of accidents occurred in the last hours of the day's work, arguing that this was the time when the children were the most tired and likely to doze off and fall into, or become careless and accidentally get entangled in, the machines. These accidents were more frequent in mornings when the children were still tired from the late nights worked the day before. In Dodd's *Narrative* he describes how

> my second sister had nearly lost her hand in the machinery. She had been working all night, and, fatigued and sleepy, had not been so watchful as she otherwise would have been; and consequently, her right hand became entangled in the machine which she was attending. Four iron teeth of a wheel, three-quarters of an inch broad, and one-quarter of an inch thick, had been forced through her hand, from the back part, among the leaders, &c.; and the fifth iron tooth fell upon the thumb, and crushed it to atoms. (196)

Instead of blaming these accidents on the dangerous machines or extreme youth of the victims, workers repeatedly pointed to their exhaustion and the need to shorten the working day, often claiming that children fell into the machinery most often during the last hours one or two of the working day—the exact hours which the Ten Hours movement argued should be omitted.

The real-life bodies which the labor process produced as deformed, mutilated, or dead therefore exist as evidence in excess of the arguments they were used to support.

This incongruence and the sheer oddity of the argumentative rationale are symptoms of the ideological pressures to construct their bodies as inherently willing and able to return to work each day undiminished, with the exact same ability and capacity as the day before to perform the labor exacted by capitalist greed in the reified form of the industrial machine's monstrous demands. In their struggles in the Ten Hours' movement, these workers had to participate in the assumption that the problem was not the machines or the capitalist who set them in motion, but only the duration of labor which must be amended to consider the capacities of "the working-class body"—an economic abstraction that they struggled to renegotiate.

As part of the formal structure that I have been calling the narrative of deformity, workers participated in struggle over the abstraction of the laboring body by reducing their bodies to calculations and quantifications, to measurable units which allowed for comparison between the deformities labor produced and the whole and able body they imagine should naturally have developed. This quantification of the body's dimensions and the calculation of its economic and physical capacities is a historical product of capitalist rationalization and fundamentally related to the early-nineteenth-century mechanization of the labor process. Through the rationalization of technology, capitalist goals for extraction of surplus value and maximization of production became the essentialized ends of technology and the measure of its efficiency. In the early factory system, the implementation of technologies that regulated the speeds and times of labor and that measured efficiency and productivity through increments of labor time resulted in the quantification of the worker's body in terms of efficiency, rendering the times of

labor exchangeable and reducing the body to a rationalized thing.[20] As Lukács describes, "labor becomes abstract, equal, comparable labor, measurable with increasing precision according to the time socially necessary for its accomplishment" (87).[21] This is why the mechanization of the labor process leads eventually to a "whole host of sciences" (Harvey 104), the purpose of which is to calculate the body's capacities measured in units of time. As demonstrated by the workers' mathematical and economic analyses of their own bodies, the rationalization of the human body becomes part of the conditions of class struggle over the abstraction of the laboring body. Workers quantify, calculate, and measure their bodies in terms of their potential to labor as the machine demands, and they measure their financial destitution in terms of their bodies' failure to sustain the labor process. As Lukács specifies: "We are concerned above all with the *principle* at work here: the principle of rationalisation based on what is and *can be calculated*" (88, emphases in original).

Though Dodd tells the stories of workers "*crippled by inches* with long hours, and constantly standing," the scientific methods he employs and the formal structure that unites all of the workers' life stories actually participate in this same reduction of the body to quantities—to inches lost and wages earned (211, original emphasis). As part of

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[20] In *The Poverty of Philosophy* Marx explains the crucial relation between the mechanization and labor time: "Through the subordination of man to the machine the situation arises in which men are effaced by their labour; in which the pendulum of the clock has become as accurate a measure of the relative activity of two workers as it is of the speed of two locomotives. Therefore, we should not say that one man's hour is worth another man's hour, but rather that one man during an hour is worth just as much as another man during an hour. Time is everything, man is nothing; he is at the most the incarnation of time. Quality no longer matters. Quantity alone decides everything: hour for hour, day for day" (57).

[21] As Lukács summarizes the development of rationalization from handicrafts to large-scale industry: "On the one hand, the process of labour is progressively broken down into abstract, rational, specialised operations so that the worker loses contact with the finished product and his work is reduced to the mechanical repetition of a specialised set of actions. On the other hand, the period of time necessary for work to be accomplished (which forms the basis of rational calculation) is converted, as mechanisation and rationalisation are intensified, from a merely empirical average figure to an objectively calculable work-stint that confronts the worker as a fixed and established reality" (88).

the comparison of the deformed body to the healthy body that workers imagine would have developed if not for factory labor, the narrative of deformity also includes careful financial accounting wherein workers compare their total life wages to the deformities and injuries they suffered, and then compare this sum total to the wages they would have received if they had been brought up to a different line of work pursued with a body allowed to develop as nature intended. In his *Narrative* Dodd provides careful and detailed calculations of his entire life's hours worked, time off, and total sum of wages, and he is outraged that "for this paltry sum I have sacrificed my health, strength, constitution, nay almost life itself" (207). If he had been brought up to a different trade, Dodd reasons, "I should have been a free man, with a good robust form and constitution," and he proceeds to calculate the sum total wages he would have earned with this other, "natural" body (207). The imagined body that should have developed is correlated to the wages a working man should naturally be able to earn with that body. Beyond simply recognizing his labor power as an exchangeable commodity, Dodd sees his body as broken parts measured by financial loss.

Dodd conducts this economic evaluation for most of the workers he interviews in *The Factory System*, totaling their hours worked, time lost to injury, and total wages earned.[22] In addition to calculating the economic dimensions of their lives, each of these autobiographies in miniature is followed by measurements of their bodily dimensions. Dodd follows the practices of medical experts, quoted at length in the opening sections of

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[22] John Reed's story provides another representative example: "I gradually became a cripple, till at the age of nineteen I was unable to stand at the machine, and was obliged to give it up. My lost time in sickness and lameness was about three months. My over-time, viz., over and above seventy-two hours per week, amounts in all to about six months. The total amount of my earnings was about 300*l*., and for this sum I have been made a miserable cripple, as you see, and cast off by those who reaped the benefit of my labour, without a single penny to bless myself with" (210).

The Factory System, in mathematically calculating actual and anticipated bodily dimensions, determining each body's intended height by measuring its wingspan. Michael Hopkins, for example, tells his life story as one of continuous labor punctuated by physical sufferings until "He was then done up, and cast off as waste lumber" (12). Dodd's physical evaluation of Hopkins follows:

> His height, as he walks, varies considerably, on account of the jumping action which he is forced to use; but, on average, he does not exceed thirty-six inches! He was perfectly straight before he went to the mill. Had he the proper use and shape of his limbs, he would be, at least, six feet high. He spans, from the tip of his right hand to the tip of his left hand, when his arms are expanded, seventy-four inches; he measures round the chest thirty-six and a half inches, round the waist thirty-three and a half inches. Nature evidently designed him for a strong athletic man. (12)

The argument and form of these narratives of deformity suggest direct correlations between the demands of the labor process, bodily development, and wages earned. The working-class body that should have developed is one that can stand—indeed that is designed to withstand—the demands of factory labor and that can earn the wages required to sustain this body. The fact that deformed, disfigured bodies develop instead reveals that the labor process wore out these bodies prematurely and unnaturally by demanding more from them than wages could recover. Like the "waste lumber" to which Hopkins compares himself, his body's damage is defined by the fact that it is discarded as unusable and unemployable.

Conclusion

The rationalization of the body and the mechanization of the labor process gave rise to a wide array of nineteenth-century cultural representations of bodies turning into machines. In Blincoe's and Dodd's accounts, the particular technological character of factory labor and the incessant, tireless demands of machinery turn workers into things by reducing them to replaceable parts of the mechanism. In his *Narrative* Dodd argues that workers become machine-like by virtue of being surrounded by things that are mechanical, as opposed to the natural and organic surroundings enjoyed by agricultural workers:

> The manufacturing labourer . . . is placed in a mill of factory as a machine, for the performance of a quantity of labour—he hears nothing but the rumbling noise of the machinery, of the harsh voice of the over-looker—sees nothing but an endless variety of shafts, drums, straps, and wheels in motion; and though these may, at first, inspire him with a feeling of respect for, and admiration of, the inventive powers of his fellow-creatures, yet this feeling will vanish, when he reflects on their power to destroy or render useless for life that exalted piece of mechanism formed by and after the image of God! (216)

Forced to work with a machine, workers argue that the machine's disregard for their physical capacities degrades them to mere objects being used by the machine, like replaceable parts to be disposed of when worn out. Blincoe's *Memoir* shows how the bodies even of small children become reduced to things: "In the mill, where Blincoe was next consigned, the *parish children* were considered, treated, and *consumed as part of the*

raw materials; their strength, their marrow, their lives, were consumed and converted into money!" (127, original emphasis). Dodd also finds that factory workers are "regarded in the same light as machines, and kept for a similar purpose, and when they have worked till their physical powers give way, they are cast off as useless lumber; just as a cylinder, or any piece of machinery, would be laid aside when worn out, and with as little remorse" (*Factory System* 106-07). Images of the body as a thing, and as machines parts specifically, are thus symptomatic of the rationalization of the body, but are also important signs of workers' participation in class struggle over the renegotiation of the abstraction of "the laboring body." The inability to critique technology is likewise symptomatic of the fact that the introduction of new technologies in the labor process is vitally related to changes in a society's abstraction of the laboring body and the refiguration of its defined capacities.

Chapter 3

Scenes of Labor:

Town and Country in *Michael Armstrong* and *Helen Fleetwood*

Written and published almost simultaneously during the years 1839-1841, Frances Trollope's *Life and Adventures of Michael Armstrong, the Factory Boy* and Charlotte Elizabeth Tonna's *Helen Fleetwood* are considered to be the first industrial novels, a sub-genre that emerged during the 1840s and 1850s and which focuses on the effects of industrialization and the condition of the working classes. With the detailed and extensive representations of laboring factory workers, factory interiors, and industrial machinery featured in both *Michael Armstrong* and *Helen Fleetwood*, however, these two innovators of the genre are actually significantly difference from every other so-called industrial novel that followed them. While Charles Dickens's *Hard Times* (1854) and Elizabeth Gaskell's *North and South* (1855) leave their readers at the factory doors, Trollope and Tonna sought to aid in factory workers' political struggles—particularly the Ten Hours Movement—by giving middle-class readers a vivid depiction of industrial working conditions.[1] Both writers had toured factories and, in addition to drawing upon their own experiences, they aimed in particular to use the novel form as a way to make the content of current reform literature, parliamentary evidence, and factory workers' autobiographies available to middle-class female novel readers who were mostly unaware

[1] Trollope's *Michael Armstrong* was published in twelve monthly shilling parts beginning in February 1839, and in book form in 1840; published in book form in 1841, Tonna's *Helen Fleetwood* was first serialized from September, 1839, to March, 1841, in the *Christian Lady's Magazine*, which Tonna edited from 1834-46.

of (and likely uninterested in) these other texts.[2]

Their indebtedness to parliamentary Blue Books and the literature of the Factory Question debates is most apparent in the novels' descriptions of labor and machinery. By criticizing the imposition of distinctly mechanical demands on workers' bodies and by providing extended comparisons between mechanized and "human" labor processes, these novels thus offered the fullest articulation of the argument initiated by critics of the factory system like James Kay Shuttleworth. In Trollope's *Michael Armstrong,* lengthy passages are devoted to describing the "whirling spindles urging the little slaves who waited on them to movements as unceasing as their own," the "slavish process of waiting upon the machinery," and the "protracted labour, during which [the children] followed the ceaseless movements of the machinery" (120, 270, 263). Mr. Parsons, the evil overlooker who beats the children if they fall asleep at the machines, remarks, "take care your hands keep up with your machinery, that's your work. . . . [A]n overlooker is not worth his salt if he does not continually keep it in his head, that the more the machinery is improved the faster must the brats move to follow it" (201). In Tonna's *Helen Fleetwood,* a character on a factory tour is confronted by the workers' listless faces, measured

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[2] Kestner describes Trollope's visit to Manchester on February 20, 1839, and lists among her source material "information from Lord Ashley, the leader of the Ten Hours Movement in the House of Commons, Parliamentary Blue Books, including the material of the Sadler Committee *Report* of 1832 on children's employment, and John Brown's *Memoir of Robert Blincoe*," and goes on to conduct a passage-by-passage comparison of *Michael Armstrong* and Blincoe's *Memoir* (52). Ivanka Kovačević and Barbara Kanner argue that Tonna's "outstanding literary innovation was her employment of official reports and inquiries as the factual basis for her stories. She was the first of the social-problem fiction writers to translate the recorded testimony of witnesses in parliamentary blue books into dialogue for her novels. In *Helen Fleetwood* we can trace the substance of the conversations of such of her characters as Tom South, Richard Green, and Hudson to official documents like the Sadler Committee Report, the pamphlets of such reformists as Peter Gaskell, Richard Oastler, James Kay (later Sir James Kay-Shuttleworth), and R. D. Grainger, the speeches of Lord Ashley, Hansard's Parliamentary Debates, and even contemporary police reports. By giving such documents a fictional framework, Mrs. Tonna brought to the average middle-class household a rudimentary knowledge of the social and economic issues under debate in the early nineteenth century" (164).

movements, and monotonous work, and he asks, "but tell me what it is makes the people look so like machines? . . . Seen at their work, they are a community of automata. Nothing seems to animate them. The cold listlessness of their look sends a chill to the heart of the spectator" (270-72). In the novel, child factory workers explain that the specific problem with working with a machine is that one can never be idle because the machine's movements are incessant and control and regulate workers' movements for them. This manner of working like a machine is contrasted with an idealized form of agricultural labor which allows one to "work like a man" by choosing to not be idle. Forcing workers' bodies to move along with a machine forecloses any opportunity for them to choose to labor morally and thus excludes factory workers from experiencing the ennobling benefits of "working like a man." It is therefore specifically in their scenes of labor, which directly pit the agricultural labor in the country against the mechanical labor in the factory town, that these novels demonstrate how the opposition between human and mechanical labor became folded into, bolstered by, and naturalized by the pre-existing aesthetic and ideological opposition between town and country.

The opposition between town and country, which became a stock feature of the industrial novel sub-genre, is generally met with critical disapproval, and even nineteenth-century readers quickly dismissed these idealized scenes of pastoral labor as mere literary convention. Catherine Gallagher, Rosemarie Bodenheimer, and Josephine Guy, for example, give the historical contexts of industrial labor conditions a backseat to their critical interest in explaining the ways the novels' varied ideological debts—religious, political, gendered—exist in tension with each other and result in the novels' formal "failures," not least of which is their reliance on the opposition between the town

and country.[3] Gallagher argues that what many have identified as aesthetic problems and formal failures in industrial problems result from the ideological tensions inhabited by their authors: "Most industrial reformers were torn between the conflicting elements in their own propaganda: on one hand they wished to assert their belief in human free will and a benign Providence, and on the other to illustrate the helplessness of individuals caught in the industrial system" (34). For Gallagher, the town / country divide is the "formal consequence" to this kind of "ideological bind" (42).[4]

Critical focus on the novels' formal failures is a symptom of the traditional method of reading industrial fiction, which has typically involved fitting analyses of particular novels into broader explanations of the entire sub-genre.[5] As a result, the ways *Michael Armstrong* and *Helen Fleetwood* fundamentally differ from their successors—most notably their scenes of labor and depictions of machinery—are usually left unexplored. This is remarkable since critics focusing on the industrial novel often take as

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[3] Gallagher's reassessment of the industrial novel was, however, extremely important in completely reopening critical consideration of the sub-genre by explaining the so-called problems in the novels as in fact tensions and contradictions in the ideologies and agendas of the reform movement. By emphasizing the novels' continuities with reformist discourse, however, critics following Gallagher have dispensed with relating representations of industrialization to historical conditions of labor.

[4] "The industrial novelists were often faced with a dilemma: they wanted to illustrate the evil consequences of industrialism, but they also wanted to avoid implying a necessary cause-and-effect relationship between a character's environment and his moral state. The tension between these two impulses caused plot incoherence, inconsistent characterization, and dissonance of both narrative voice and mode in some industrial novels. . . . torn between poles of freedom and determinism" (21). "Because it is impossible to explain M. in providential terms, the narrator introduces the completely different, indeed antithetical, causal scheme of economic and social determinism to account for the factory town's existence. The author thereby creates an ideological bind: her religious principles lead to her criticism of industrial society, but her criticism draws her away from a providential explanation of events. The formal consequence of this bind is a division of the fictional world into providential and antiprovidential territories. In its simplest form, this division separates the country from the industrial town" (42).

[5] This mode of examining the novels as a group began with Louis Cazamian's *Le Roman Social en Angleterre, 1830-1850: Dickens, Disraeli, Mrs Gaskell, Kingsley* (1903) and Kathleen Tillotson's *Novels of the Eighteen-Forties* (1954), but was really cemented by Raymond Williams's *Culture and Society 1780-1950* (1863), which is still taken as a critical starting point by the majority of literary critics working on these novels. Other influential examples of this critical treatment of industrial fiction include Joseph Kestner's *Protest and Reform: The British Social Narrative by Women 1827-1867* (1985).

their starting point a rehearsal of the common observation that scenes of industrial labor are surprisingly non-existent in the Victorian novel. Carolyn Lesjak, for example, remarks, "To put it baldly, one is hard put to find representations of industrial labor in [Victorian] literature. . . . [E]ven a cursory look at its 'classics' . . . reveals a marked *absence* of representations of work or workers working" (2, original emphasis).[6] Explanations for this absence generally return to Raymond Williams's "structure of feeling" argument, which claims that the Victorians' initial sympathetic concern for the working class develops in industrial novels into a fear of revolt and desire for containment.[7] While Williams's argument has been significantly critiqued and refined, no one has disputed the general conclusion in the critical conversation that middle-class fear explains the sub-genre's failure to represent working-class laborers.[8] This chapter offers an alternative to this critical assumption by foregrounding the scenes of labor and industrial machinery in *Michael Armstrong* and *Helen Fleetwood*, and by suggesting that the reason why later industrial fiction ceased including similar scenes lies not in the

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[6] Given the assumed paucity of working-class characters and labor in the industrial novel, many critics focus on the sub-genre's concern with its middle-class audience. For example, Rosemarie Bodenheimer states, "For us the novels may be less about factory conditions or the status of trade unions than about the patterns of contradiction and paradox which characterize the formal fantasies of people living through a period of unprecedented social change. . . . the content of those patterns points to a middle-class crisis of self-definition: in so far as the social problem novels can be treated as a group, they display conflict about the nature and diversity of a newly empowered and newly fragmented middle class as they attempt to reimagine the roles that it should play in the maintenance of social order" (5). Following this setting aside of the industrial novels' depictions of industry, the dominant mode of reading these texts centers on their depiction of middle-class roles in social reform, for example, the way middle-class female characters feature in "solving" the social and economic problems the novels represent (Dzelzainis), or the ways the novels train middle-class female readers how to "feel for the poor" (Betensky).

[7] Williams writes that, in the Victorian industrial novels, "Recognition of evil was balanced by fear of becoming involved. . . Sympathy was transformed, not into action, but into withdrawal" (109). Williams has explained the idea of a "structure of feeling" as follows: "We are talking about characteristic elements of impulse, restraint and tone; specifically affective elements of consciousness and relationships: not feeling against thought, but thought as felt and feeling as thought: practical consciousness of a present kind, in a living and interrelating communing" (qtd. in Wallis, 129).

[8] Lesjak, for example, states the Victorian novel transferred the problems of labor onto the domestic sphere, thus substituting labor with pleasure, due to concerns for "the problem of representing labor without also raising the specter of the economic and social inequalities on which it is based" (6).

problem of representing labor, but rather in the problem of representing the machine.

Moreover, this chapter argues that Trollope's *Michael Armstrong* and Tonna's *Helen Fleetwood* provide a case study demonstrating one way the opposition between human and mechanical labor constructed by the Factory Question debates made its way into the larger culture, in this instance through its incorporation into the pre-existing aesthetic and ideological opposition between the town and the country. While both novels certainly draw upon stock imagery and idealize agricultural labor as unrealistically natural and painless, closer examination reveals the ways these literary conventions functioned as central parts of the novels' social critique.[9] Specifically, by taking the opposition between human and mechanical labor produced in the Factory Question debates, and layering this on top of the existing opposition between town and country, these novels extended the critique of the mechanization of the labor process into a critique of the material social relations that determine town life in its entirety. In both novels, representations of the paternalistic and more seemingly "human" social relations that structure agricultural labor serve as a critique of the ways employer / employee relations in the factory were mediated by the machine. Just as critics of the factory system premised their critique of mechanized labor on its opposition to the constructed idea of "human" labor, so too do the industrial novels rely on a construction of an idealized agricultural labor process in order to showcase the problems with its binary opposite. The function of the idealized scenes of country labor is not to propose a solution or a legitimate alternative to town life, but merely to showcase through comparison the

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9 Examinations of the town / country binary in *Michael Armstrong* and *Helen Fleetwood* generally center on determining the particular ideological and aesthetic debts of their pastoral scenes, particularly establishing links to particular strands of Romantic thought. See especially Bodenheimer, 130-35.

critique of industrial labor.[10]

Part 1: Working Like a Man / Working Like a Machine

In *Michael Armstrong* and *Helen Fleetwood* rural labor is described as energizing, healthful, and in every way the exact opposite of mechanized factory labor. In Trollope's *Michael Armstrong*, country labor heals bodies, cures their lameness, and undoes years of damage from factory labor. The novel begins with Michael and his lame elder brother Edward living in extreme poverty with their sickly mother and working in a factory owned by Sir Matthew Dowling. Michael helps remove a cow from the path of the Dowling family carriage and as a reward is "rescued" from his loving family and adopted by the Dowlings. Michael is dressed up in the clothes of the Dowling children and made a symbol of the family's benevolence: the family puts on a play re-enacting the scene of his adoption and Sir Matthew Dowling writes an article called "English Benevolence," published anonymously in the local county newspaper, praising himself for taking in Michael. But behind closed doors he is cruelly abused by the family, and in one instance a chicken is thrown at his head. Michael is soon removed from the family home and sent as an apprentice to Deep Valley Mill, where the working and living conditions suffered by the children are even worse than at the Dowling factory.[11]

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[10] The form of my argument thus parallels that of Rosemarie Bodenheimer, who argues that many industrial novels "create pastoral realms and mythic histories that function as alternatives or correctives to courses of thought and action fixed in the social order. Fictional appeals to nature or to a value-laden past are particularly open to dismissal as escapist or nostalgic fantasy. But in the dialectic of narrative argument, they can function as genuine alternatives: not as better worlds elsewhere but as challenges to the assumptions of a dominant social theory. . . . In the texture of these narratives, post-Wordsworthian pastoral writing emerges as a complex arena of resistance to the environmentalist view of character rather than as a univocal gesture toward a utopian place" (9).

[11] Trollope modeled Deep Valley on the account of Litton in Derbyshire in Blincoe's *Memoir* (Grey 145).

Meanwhile, the young, orphaned heiress Mary Brotherton determines to learn about the factory workers from whom she gains her substantial wealth and to discover what makes them so fundamentally different from other members of the working classes, particularly the "peasants [who] live and die contented with a life of HEALTHFUL AND RESPECTED toil" (144). She takes in Michael's brother, Edward, and after completely healing his lameness through "change of air" and "fresh fields and pastures" decides to educate and groom him as a gentleman (419). Mary tries to rescue Michael from Deep Valley Mill, but comes to believe he has dies and so she rescues Michael's sweetheart and fellow worker Fanny Fletcher instead. While at Deep Valley, Michael gets the opportunity to do some outdoor work, and though still miserable labor, it is "the balm of health compared to the monotonous and grinding slavery of the mill," and it significantly improves his strength and constitution (398). He eventually escapes from Deep Valley and works for a few years as shepherd, and this country labor enables him to fully regain his lost health, heal his damaged body, and fulfill the natural bodily potential promised by his name (arm-strong) so that later in life he is unrecognizable as a factory boy. His brief stint in this country setting is directly responsible for his physical turnaround, though, we are told, had he "remained a year or two longer at the Deep Valley factory . . . it would have been too late for any contemplation of God's works to have roused his withered spirit to worship and to hope. But as it was, his mind seemed to awaken day by day from the long and heavy sleep in which it had been plunged" (429). Eventually, Michael, Edward, Fanny, and Mary are all reunited, the two couples pair off for future marriage, and Matthew Dowling dies in bankruptcy and shame, surrounded on his deathbed by hallucinations of the deformed and disfigured bodies of hundreds of factory children.

While *Michael Armstrong* demonstrates the positive, healing effects of country labor on characters' bodies, Tonna's *Helen Fleetwood* centers on the separation of characters in youth so that over the course of the novel readers may see the factory children decline physically, mentally, and spiritually, while the children who remain in agricultural work flourish in their robust health and moral development. Throughout the novel scenes of dismal, bleak, filthy town poverty are repeatedly set against idyllic scenes of country life featuring "the sun-burnt peasant, bare-headed, or with handkerchief knotted round his brow, in the sweat of which he had tilled the soil, and gathered in the harvest" (177). The novel begins when the widow Green, who cares for her grandchildren and the orphan Helen Fleetwood, is forced to move the children from their rural cottage to a factory town, though she is immediately concerned for the spiritual welfare of the children: "a country life makes things come easy enough that one can't think of doing in a town. . . . scriptural teaching, prayer, and watchfulness over the young; surely they are rendered even more necessary where temptations abound, as they plainly do here. . . . but you can't keep your eye on the children, as you do in the country" (81). The Greens are befriended by the Wright family, the opposition of their two family names—"Green" signifying nature, and "Wright" implying making or manufactures—signaling the ways the families will be contrasted. All of the Wright children have been maimed or disfigured by factory labor: their bodies "betrayed a deficiency or a perversion of natural growth" (44); Charles "rose as he spoke, or rather stood; for no perceptible difference was made in his height by the change of position, owing to the curvature of his legs. The deformity was striking, and the irregular shuffle with which he crossed the room painful to witness" (46); "Poor Sarah had only one arm, and that one so contracted as to be nearly

useless; while her feet were bent in, until she rested on the ankle-bones" (60). The widow Green initially tries to avoid sending her children to work in the factory, but is eventually forced to relent, and the Green children quickly begin to physically deteriorate and become as jaded as the Wright children.

Years go by, and then Richard, Helen's childhood sweetheart who remained in the country, learns of the Green family's situation in the factory town and sets off to help them. While Helen and the rest of the Green children have declined, Richard has thrived from a life of "healthful labor in his native fields" (110) and "country air and good hard work" (189). Richard is always seen frolicking around in the country, enjoying his agricultural labor, and doing things like "leaping over a five-barred gate, and giving chase to a playful young colt that bounded away on his sudden appearance" (189). When he arrives in the town and observes the people, he realizes his good fortune:

> The conviction flashed upon him of how much the scenes in which he had lived and acted had contributed to form his character. Take away sunny landscape, the broad fields, carpeted with smiling flowers, the shady banks, the towering trees, the high open canopy of heaven, and the sea . . . take these away, and Richard could not only regard the world as a dreary, joyless spot, compared with what he had found it. (221)

The Green children, however, have been deprived of all this, and their health deteriorates rapidly. Helen suffers "weakness of the ankles, the narrowness, so to speak, of the frame, a stoop, and a quickness of breathing, together with the increasing paleness of her complexion," and though it is immediately suggested, "Would not country air, and exercise, and the way of living she was used to, cure it all?" (257), Richard has returned

too late: even though Helen is the angel and the moral center, by the end of the novel she is dead, thwarting the implied marriage plot.

In *Helen Fleetwood*, it is not simply that time in the country is healthful and curative as opposed to time spent in the filthy, polluted town. The novel integrates into this standard view of the town and the country a specific critique of the mechanized labor process. Whereas in the country workers direct their own labor, in the factory workers are robbed of the ennobling aspects of work by the machines which force labor onto the workers' bodies. The widow Green repeatedly instructs her grandchildren that God does not want them to be idle, to which Helen replies, "If it was to depend on ourselves and each other, granny, we might be idle: but you forget we have to work along with the machinery. *That* is never idle; it goes on, on, on, and we must keep pace with it" (115, original emphasis). Though members of the upper classes assume that the workers detest factory work because they are a "race of idlers," factory workers are actually robbed of option of being idle because they are controlled by the machine.

The ennobling benefits of this human labor are illustrated by Richard. Upon arriving at the town, and before seeing the factory for himself, Richard compares his agricultural labor to that of a factory workers he's just met: "You lazy manufacturers are so used to see the machinery do your work for you, that you can't judge of us field laborers, who carry all before us by mere strength and perseverance.' Hudson smiled: 'You have odd notions of machinery, my fine fellow, if you think it does our work for us. It only makes us work.' 'Little's the machinery I want to keep me agoing, when the work to be done is for the advantage of—" (261), cutting himself off lest he betray his intentions to marry Helen. Richard suddenly realizes the advantages of his agricultural

labors:

> I have worked like a man, not like a wheel and pulley. My mind has gone along with my hands, and I had something to keep me in remembrance with I was better than the space I dug with. I never was idly disposed; but if fatigue came over me for a minute or so, I could stop my spade and rest upon it; it didn't dig of itself, and force my foot to follow it. (269-70)

This "something" which Richard remembers while he works in the field is God, and he is able to remember his place in God's system because he is laboring in nature, and thus surrounded by such remembrances. Disconnected from nature, however, factory workers suffer "the total absence of all that can elevate the mind, even so far as an habitual contemplation of God's works elevates that of the plough-boy, or expands it into social kindliness among loving kindred, or pleasant companions":

> See at their work, they are a community of automata. Nothing seems to animate them. The cold listlessness of their looks sends a chill to the heart of the spectator, who, if he feels rightly, must feel it a degradation to his species to be chained, as it were, to a parcel of senseless machinery, confused by its din, and forced to obey its movements with scarcely an interval for thought or for repose. . . . this stamps the character of vacancy, selfishness, and gloom, on faces that should beam with the gladness, if not with the intelligence, of youth. (272)

Workers become "automata" when they are removed from the nature and from the paternalistic relations to their employers, both of which are idealized as the sources of both motivation and pleasure in agricultural labor. Robbed of these pleasures and of the

ability to direct and control their own labor, they become as heartless and thoughtless as the "parcel of senseless machinery" to which they are "chained." Both novels base their critique of factory labor in nostalgia for a time when labor and pleasure were supposedly unified for the working class, and argue that industrialism, removal from the countryside, and the breakdown of paternal relationships severed these things.[12] This nostalgia and the idea that of a time when labor and labor relations were pleasurable and non-exploitative is clearly ideological; however, in dismissing these novels' scenes of rural labor in this way, we miss the critical, persuasive, and pragmatic use of this nostalgia: as a critique of the mechanized labor process.

Part 2: Paternalism, Social Relations, and the Production of Bodies in Space

The ways that *Michael Armstrong* and *Helen Fleetwood* rely on the opposition between town and country are clearly derivative of a long tradition of pastoral literary convention. But this conventional opposition between town and country was also central to arguments against the factory system throughout the Factory Question debates. During the decade before these novels were written and published, critics of the factory system regularly depicted agricultural and rural labor as an idealized counterpart to factory labor. Pro-industry apologists for the factory system were quick to pick up on the derivative aesthetics employed by the factory system's critics. Cooke-Taylor, for example, wrote that "There are many who will doubt or disbelieve the fact that mill-work is preferred to agricultural labour by young persons" specifically because "their imaginations have been

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[12] By directly comparing the freedom of rural labor against the stifling control of the factory's mechanized labor process, *Michael Armstrong* and *Helen Fleetwood* offer exceptions to Lesjak's argument that the industrial novel initiated the excision of labor from Victorian novel as part of its location of pleasure in the domestic realm.

too long dazzled by Arcadian pictures of rural life, for them to take the trouble of attending to sober realities" (26).[13] He zeros in on the assumptions made about country labor, and offers an explanation for its idealization: "One great cause of the prevalent delusion is, that agricultural labour is rarely witnessed by casual spectators except during fine weather. Persons taking an excursion for pleasure on a summer's day, when their own spirits are exhilarated and their own hearts cheered, naturally associate the pleasurable feelings of which they are conscious with all the objects around them" (26). He claims that if these same spectators witnessed agricultural labor "under heavy rain, during sleet, or during a very severe frost, they would form very different notions of the dripping and shivering beings in the fields around them" (26).[14] While Cooke-Taylor concedes that "In the great towns the factories have had to contend with all the nuisances which an increase of population beyond the due limits of accommodation must necessarily produce," his largest point is that there is no causal connection between the problems of the town and the actual labor of factory employment. He accuses critics of the factory system of assuming that "the great-town nuisance is identical or connected with the factory system. Hence visitors to Manchester make the double blunder of believing that all its working-classes belong to the factory population, and that all the health and misconduct they witness among females of the lower rank in that town may be

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13 The problem, as he explains it, has primarily to do with this skewed perspective: "Were a North American Indian or New Zealand chieftain introduced into one of our highest schools, he would waste much pity and compassion on the poor boys condemned to pore [*sic*] over books and on disagreeable tasks instead of taking healthful exercise in the open air, enjoying the excitement of the chase, of freely sporting over the plain. Were he able to write, and a rival of Mrs. Trollope in imaginative invective, his "English School Boy" would beat that lady's "Factory Boy," or, as it was more appropriately designated, her "Unsatisfactory Boy," all to nothing" (23)

14 Cooke-Taylor goes on to offer evidence supporting his claim that "The tenters, piecers, and cleaners escape that exposure to the vicissitudes of the season under which the agricultural children suffer, and such young persons as have tried both invariably assign their protection from wet and cold as the chief reason for their preferring factory labour" (26).

ascribed to the factory system" (39).

Given the prevailing assumption that the working-classes were prone to immorality and idleness, it was difficult for reformers to defend the working-class population against the charge that they were responsible for the living conditions and depravity in the factory towns. Peter Gaskell, for example, though harshly critical of the factory system, goes to great lengths to demonstrate the scientific validity of his comparison between the health of town workers and country workers, and even then he makes only the most indirect connection between factory labor and the physical effects on workers. Gaskell's *The Manufacturing Population of England, Its Moral, Social, and Physical Conditions, and the Changes Which Have Arisen from the Uses of Steam Machinery* (1833), offers a scientific explanation for the difference between town and country bodies based in his analysis of infant bone development. He begins with an anecdote about a healthy child born in an agricultural district who moves to a factory town quite early in life where he is exposed every disgusting element of town life. The child develops an array of physical problems due entirely to these environmental causes but, Gaskell explains, "it seldom goes down below this, its bony fabric having attained already so much firmness and completeness of ossification as to prevent it from yielding to any great degree" (158). Through a lengthy analysis of bone development, Gaskell asserts that rural children and town children experience life and labor differently and bear different bodily marks of this experience because merely occupying different spaces during their formative years has made them irreversibly different at a skeletal level. He concedes the long and well-rehearsed list of physical atrocities suffered by factory laborers, but claims "These effects are necessarily produced only in instances where

ossification has been retarded, and it has been shown how the conditions of the child born and bred up in large towns tend to this state" (160). Unlike an unhealthy town child, whose "bony fabric has had no opportunity for becoming properly solidified," the fundamentally strong country child "whose early years have been passed in healthy localities, and had home-tendance, is far more advantageously framed for work, and much less liable to the yielding of osseous supports, than the child differently circumstanced" (159). A child from an agricultural background, on the other hand, can only be damaged by factory labor down to the muscle. Gaskell not only claims that factory labor is suitable for small children, but also supports the system of importing laborers from the country to replenish the town workforce which was being constantly diminished as, inevitably, children either outgrew factory labor, became physically unable to continue working, or simply died.

While Gaskell is critical of the overall factory system, he is hesitant to blame mill owners for physical ailments for which he believes the workers themselves are at least partly to blame since they contributed to the filthy and immoral conditions of town life. Stepping back from a full on critique of the machinery, he claims that "The real evil lies in the habits of the people themselves; habits, it is very true, generated by the system of factory labour: and one half of the mischiefs suffered by the children are inflicted upon them prior to the commencing work" (166). These are factors for which employers cannot be held responsible: "It would, indeed, be a monstrous perversion of every thing like justice, both to the masters and to the system of factory-labour, to burden the one with the moral responsibility of this prior condition, or the other with all the results for which it paves the way" (156-57).

Gaskell's statements in this section seem to stand in clear contradiction to the other portions of the book where he criticizes the factory system, particularly the mechanized labor process through which the worker becomes part of the machine due to the fact that mechanization has devalued the worker's labor: "he will no longer be a man proud of his skill and ingenuity, and conscious that he is a valuable member of society; he will have lost all free agency, and will be as much a part of the machines around him as the wheels or cranks which communicate motion" (358). The seeming contradiction on Gaskell's logic reveals how difficult it was for even critics of the factory system to respond to arguments like Cooke-Taylor's, which claimed that factory owners could not be held responsible for the problems of the factory town.

The contradiction can also perhaps be explained using the argument made by Josephine Guy, whose book-length critique of recent decades' literary-critical approaches to the industrial novel claims that scholars primarily faults these texts for failing to develop systemic critiques. She explains that Victorian writers "tended to understand problems in society in individual, rather than social terms. . . . [A]n understanding of the social, and therefore of social causation and social change, was always made by reference to individual agency" (10). She claims that most critical readings of industrial novels center on "an implication that there was another (and better) novel about problems in mid-nineteenth-century society which Dickens, Eliot, Gaskell, Kingsley or Disraeli *could* have written, but for some reason failed to do so" (67). She aims to intervene in this tradition by emphasizing the degree to which a systemic critique was an unavailable strategy for Victorian writers of industrial novels, arguing that the "'solutions' which Victorian writers prescribe are solutions to problems which they perceived and defined

quite differently from the ways in which a modern social commentator would" (10).

In the case of Gaskell's reform writings, Guy's argument can account for his ability to launch a ruthless critique of the factory system in one portion of his book, while remaining unable develop a systemic critique that understood the space of the factory town as an effect of the class conditions lived by factory workers. As defined by David Harvey, class is "positionality with respect to capital circulation and accumulation" (413). Building on Harvey's starting point, Reecia Orzeck explains that a historical materialist approach to the body must attend to the fact that "Different types of labour transform the body in different ways" in addition to realizing that

> Equally material are the transformations of the body that take place beyond the workplace which owe their existence not to a type of work but to a worker's location within the nexus of social relations—relations which include uneven development and the division of labour as well as structural factors such as racism and patriarchy. Income, access to healthcare and education, environmental racism, etc. are all, like occupational injury and disease, factors that *shape* bodies. (503, original emphasis)

While this brand of systemic critique of the historical materialist production of bodies in space was of course utterly unavailable to nineteenth-century social critics like Gaskell, it is available to current readers of the industrial novel. Largely persuaded by Guy's point, I suggest that quick dismissals of the opposition between town and country in *Michael Armstrong* and *Helen Fleetwood* actually align modern-day critics with arguments like Cooke-Taylor's that deny a systemic connection between the class conditions of labor,

and the class conditions of space beyond the shop floor.

While I do not seek to find in Trollope or Tonna a Marxist theoretical program that was clearly unavailable to them at the time, I do mean to suggest that failure to understand the connections their novels pose between the spaces of town and country and the labor processes and social relations that each space symbolizes opens critics to a Marxist critique, specifically one that bears in mind work by cultural geographers like Harvey and Orzeck on the production of bodies in space. While both novels' representations of agricultural labor are clearly idealized, because they are novels, these texts are better able to represent the factory system *as a system*; and because they are fictions that presented arguments symbolically, rather than polemics like Gaskell's, these novels are able to move closer toward the kind of systemic critique that Guy claims literary critics desire. However, because this kind of analysis involves taking seriously images of town and country which are largely derivative, idealized, and conventional, their centrality to the novels' critique has yet to be fully recognized. Focusing on the aesthetic meanings of the country scenes has drawn attention away from the fact that these scenes attempt to introduce a larger scope of class conditions beyond the immediate labor process.

Both novels argue that in the country, work is structured by paternalistic relationships, whereas in the towns workers are treated like property—either slaves or pieces of the machinery—and employers don't know or care about their workers' physical or moral well-being. In *Michael Armstrong,* Mary Brotherton becomes interested in the lives of the factory workers from whom she's gained her significant wealth primarily because, she laments, "What a sad thing it is that we all know so little of

the poor people employed in the factories! . . . I know it is not so in other places; for I have heard my schoolfellows continually talk of their fathers' tenants and work-people, and of their schools, and their clothing societies, and all sorts of things" (156-57). Learning from the examples of her friends among the landed aristocracy, Mary regrets that town people lack "the same family feeling and attachment" (138) enjoyed by country families: "Why do we not know something about our poor people, as the people with landed estates know about theirs? The factory people should be noticed by the gentlefolks, and treated in the same way as labourers that work the land" (140). Mary is cautioned that she should not go onto the dwellings or neighborhoods of the poor, as their manners and behavior would shock her, but she decides that the poor people cannot be blamed for their behavior because they lack a good example set by their superiors.

In *Helen Fleetwood*, the widow Green is shocked to learn that the care and attention country laborers receive from their land-owning superiors is wholly absent for her grandchildren in the factory: "All that the overlookers care for is to see everybody feeding the engines, or drawing out the cotton, winding, piecening, and all the rest of the business. . . . You are greatly mistaken if you think the men who overlook our work care for our morals—they themselves are often among the worst of the bad" (115). This lack of a moral example is contrasted with an idealized image of paternalistic class relations in the country:

> The Squire was pleased at the diligence with which [his workers] had availed themselves of the favorable season; the men were gratified by his praises, and no less by his liberality; while the women and elder children, who had found plentiful employment too upon his extensive lands, had

> similar cause for gladness. As for the little ones, they were delighted to gambol and exhibit their activity in the presence of the Squire's family, whose daughters took no small pains in disciplining the urchins at their infant school, and marshaling them for an orderly march to the church door. Each, both old and young, enjoyed that peculiar feeling, the value of which the poor are seldom aware of until they experience its absence: "My employer knows me; I am not in his sight a mere piece of machinery, regarded only while it works in his service. There's a tie between us that he, though a rich man, would not disown. If he is everything to me, I and mine are something to him." It was this thought, unconsciously cherished, that lighted up every countenance with smiles as the Squire's family approached the happy groups. (179-80)

Helen sees the potential for good that could be done if Parliament compelled factory owners to use certain hours of the day to educate their child workers, and she imagines the factory owner's daughters "superintending the instruction of their young servants in religious and useful knowledge; shaming vice, overawing insolence, encouraging modesty, industry and cleanliness, by the mere force of their frequent presence and occasional admonitions. . . . oh, what a refreshment to body and mind would this have secured to the poor little toil-worn creatures! by what a tie of respectful affection, and consequent diligence and integrity in his service, would it have bound them to their master!" (176). Helen's ideas involve importing the kinds of social relations that structure agricultural labor into the town and integrating them into the factory so as to humanize mechanical labor.

While both novels to offer this importation of paternalistic social relations as a genuine possibility, but they both imply that the primary difficulty lies in the fact that people in the factory towns are surrounded by machinery which has come to characterize their social relations. Richard explains that he has learned his natural place in the social system from observing the examples around him in nature: "'I am a plain country laborer, used to farming; and I find a great deal of instruction in observing the things that I am employed in. . . . Perhaps,' added Richard, smiling, 'perhaps you that live among machinery, and see everything done by steam, may take different views'" (236). The key example of his education in nature is when he learned patriarchy as a child on the farm:

> Often had little Richard Green looked admiringly on while the monarch of their small fowl-yard bent a patronizing eye upon the hens and chickens . . . and with delighted interest did the child contemplate the character which he regarded as his future model. . . . he says 'all the tiny chicks belong to his family . . . instead of gobbling it up all alone, he calls them, and looks on better pleased to see them enjoy it than to eat it himself. And then if anybody meddles with the hens or chickens, what a fuss he gets into! . . . I will be like Strut when I am a man. I will take care of my granny as he does of his, and of the rest as he does the chickens. (185-86).

In contrast to the paternalistic relationships that benefit country workers, in the towns factory workers are treated like machines, things, commodities, "compelled to link themselves to wheels . . . the whirling frame of his human machine" (273). Helen complains, "I fear they regard us only as machines, while making a great show of raising us in the scale of knowledge; and so they are loading, as it were to the muzzle, a gun that

will burst and destroy them," adding later, "I felt as if the hot, unnatural air would melt away all that was good for anything in me, and leave me like one of the senseless machines, to do just whatever I was set about, right or wrong; and you know what advantages the devil will take of that state of mind" (252, 279). This link was often made in the factory question literature between the mechanization of the labor process, and psychological effects which primed the mechanized worker for revolt like a loaded gun. During Richard's factory tour he immediately notices that "The same mechanical employment occupied each individual laborer—a human piece of mechanism, attached to those of iron and leather, passing to and fro within a confined space, with an air of vacant listlessness such as Richard had never beheld among any class of work-people. . . . Their minds seemed to stagnate, their spirits to have wholly evaporated, and a sort of indifference, the furthest possibility removed from all feeling of enjoyment, reigned supreme" (265; 269). Turned into machines in body and spirit, factory workers are "glad of any excitement to awaken their drowsy spirits" (297). Turning the working class into machines in body and spirit creates the conditions for revolution by paving the way for Socialism and Chartism by transforming workers from "their country's pride, into a degraded, discontented, restless, reckless, turbulent mob. Two classes, hitherto bound together by mutual interests and mutual respect, are daily becoming opposed the one to the other" (291). This logic, based on an idealized view of agricultural labor as not only healthful and enjoyable, but also as not exploitative, places the blame for factory worker discontent on the factory owners who have failed to preserve traditional paternalistic relationships with workers, and on the changes to the labor process which have mechanized the workers' bodies and minds, leaving them intellectually and spiritually

prone to discontent and socialism.

Conclusion: The Disappearance of the Machine

Following Gallagher's argument about the eventual decline of the industrial novel and the disappearance of labor and its politics from Victorian fiction by the 1860s, critical interest in the sub-genre has had to contend with the fact that, as Lesjak puts it, "labor is *always hard to see* in the novel—even in the industrial novel where Gallagher assumes it is really to be found—and that its visibility (or lack thereof) is an integral part of its composition" (2, original emphasis). Lesjak finds an explanation for this phenomenon in a modified version of Raymond Williams's classic argument that the industrial novels of the 1840s and 1850s exemplify the tension between a desire to evoke sympathy for the working classes and a reluctance to expose the exploitation and class inequities that demand this sympathy out of a fear of violent revolt, resulting in the industrial novels' dominant "structure of feeling" or strategy of containment. Following Williams, the absence of labor in industrial novels has been interpreted as a symptom of the overall problem with the sub-genre; as Lesjak explains it, "the industrial novel becomes a place where labor can be 'seen' not because it is being directly represented or visibly foregrounded but because the attempt to represent the working class at all necessitates an engagement with labor's overall problematic: how to represent industrial labor and working-class laborers without simultaneously promoting social revolution" (3).[15]

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[15] Lesjak's larger argument is that "Labor 'disappears' from these novels . . . not because it is not there but rather because it has been separated from the domestic concerns which come to occupy the center of these texts—and which can be resolved in a way that the problems of labor cannot" (14).

Michael Armstrong and *Helen Fleetwood* in fact rely on descriptions of labor and machinery in order to bring the threats of Socialism and Chartism to the forefront of their readers' concerns with the plight of factory workers. In this way these novels are clearly not representative of the dynamic Williams describes, yet critics persist in including both texts in assessments of the industrial novel defined by Williams's "structure of feeling," rather than fully exploring how the representations of labor, machinery, and unrest in both novels mark significant differences from the industrial novels that followed them. Examination of the tensions within the political arguments advanced by *Michael Armstrong* and *Helen Fleetwood* suggest that perhaps the problem encountered by later industrial novels was not the challenge of representing labor, but the challenge of representing industrial machinery without either glorifying or critiquing the machines.

The real tensions in these two novels have less to do with a fear of exposing class inequities or condoning working-class violence, than with the difficulties of representing the machine. Both texts foreground their commitment to the fundamentally political project of the Ten Hours movement, and *Helen Fleetwood* goes so far as to blame the potential for Socialism and Chartism on the mechanized labor process, not on the workers with who readers should sympathize. Furthermore, any critique of machinery would appear ludicrous at this time because it denied the machinery as a cultural symbol of scientific advancement and cultural superiority. This kind of critique posed a representational challenge, as well. The machines were of such an awesome scale and so technologically impressive, that any description of machinery would be in tension with a critique of the factory system which that machinery enabled. However black, smoggy, dirty, and bleak as the towns were described, there was no getting around the fact that the

machinery was awe-inspiring, and that this perspective could not help but be conveyed in any description of its scale, capabilities, size, and speed. As Thomas Carlyle describes in *Chartism*, upon entering a factory one sees "ten-thousand times ten-thousand spools and spindles all set humming there,—it is perhaps, if thou knew it well, sublime as a Niagara, or more so" (51).

Carlyle's assessment was not unique. As more and more parliamentary inquiries and special committee reports found their way into popular newspapers, the vogue for factory tourism increased, and specialists of various professions as well as curious lay-people flocked to the factory districts to see the factories for themselves. To give just one example, in 1835 Sir George Head published *A Home Tour through the Manufacturing Districts of England*. The machinery is presented as the culmination of his tour:

> After viewing the manufactory, I ascended by a flight of steps to the small stone building containing one of the said steam-engines. Although so vast a power was in action, not the slightest tremulous or other motion was perceptible; the enormous fly-wheel spinning meanwhile in silence, though weighing some tons, close to the wall; and the harmony of the movements of the engine altogether was so perfect and free from friction, the brilliancy of polish bestowed on many parts so lustrous, and the care and attention paid to the whole so apparent, that imagination might readily have transformed the edifice to a temple, dedicated by man, grateful for the stupendous power that moved within, to Him who built the universe. (184)

For Head, the machine is a triumph. The vastness of its power, its size, and its "brilliancy of polish" are all testaments to the steam engine as an almost magical human

achievement. The silence of the engine is inexplicable, but Head's feeling of being overwhelmed, which the passage captures through his insistence on the machine's silence, is common in all accounts of a tourist's first view of the machinery.

Helen Fleetwood responds to this common view of the machinery by asking its middle-class reader to view the machinery from the worker's perspective. When Helen, who the reader sympathizes with as our angelic orphan, first sees the machinery, she is similarly overwhelmed:

> Move, move, everything moves. The wheels and the frames are always going, and the little reels twirl round as fast as ever they can; and the pulleys, and chains, and great iron works over-head, are all moving; and the cotton moves so fast that it is hard to piece it quick enough and there is a great dust, and such a noise of whirr, whirr, whirr, that at first I did not know whether I was not standing on my head. (85)[16]

The structure of Helen's sentence—"and . . . and . . . and"—reproduces for the reader her experience at the center of the incessantly spinning machinery as she is surrounded by a twirling, whirring, and "always going" succession of sensory stimuli. The speed causes her overstimulation, as the parts of the mechanism, the dust, and the noises pass by her so fast that she has not the time to focus on what she is experiencing, let alone her task of

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[16] While the gentle, kind Helen is shocked and doesn't know if she's standing on her head, a less-feeling viewer remarks that the task of "scavenging" in the mill

> "made me laugh. You see, bits of cotton wool will stick to the thread, and they musn't go on the reels; so there is a little girl huddled up under the frame and she snatches off all the loose wool, and throws it down so fast! and when the machine runs back, if the little scavenger did not bob and duck, and get very low, she would have a fine knock on the head."
>
> "Poor thing!" said Helen, "she can never stretch herself out, hardly; and she is chocked and smothered in the dust of the light cotton bit that she has to pull and scatter about her?"
>
> "I did not think of that," replied Mary, "it amused me to see her so frightened and all in a bustle, so I laughed." (86)

piecing the threads.

Like Helen, who does not know if she is standing on her head, Richard is also overwhelmed when he first sees the machinery during his factory tour:

> The pulsation of the boarding on which he stood, as the thundering strokes fell rapidly upon his ear, almost dismayed the astonished rustic, and he shrank with cautious eye from approaching the narrow chasm within which the wheel was carried round with such a tremendous sweep. Near the door was a tall upright frame, round which two iron balls were whirled at the extremity of strong rods. Everything was on a scale so gigantic, the motion was so impetuous, the noise so deafening, that he felt stunned. (265-66)

While both Helen and Richard view the machinery from the perspective of the uninitiated, their view is not that of an upper-class tourist like Sir George Head, but of a worker. Their physical reactions allow readers to see the machine not simply as a tourist would, but almost from inside it, and as one forced to work alongside it. We are forced also to consider the experience that a small child would have in an industrial factory if even Richard—our hero who we believe will rescue Helen and her entire family from the clutches of the factory system—is endangered next to the machine and dwarfed by its "gigantic scale." Shrinking back from the "narrow chasm" only brings him closer to dangerously whirling iron rods, and we get the sense that the machine's motions are so out of control, so "impetuous," that Richard becomes reduced himself to a small child in search of a protected space, yet unable to react and alertly escape danger in his "stunned" and overstimulated mental state.

In *Helen Fleetwood*, the worker's perspective of the machine functions as a corrective to the view of the machine from the perspective of an enthralled and awestruck middle-class tourist. *Michael Armstrong* goes further in directly attacking this dominant view, and aims to retrain its readers in how to see the machine when Mary poses as a tourist so that she may inspect the factory. Her view of the machine is prefaced by the narrator's comment, which acts as a footnote to the numerous accounts of awe-inspiring machinery with which the novel's readers were likely familiar:

> It is probable, from the drowsiness of the public mind on the subject, that many travelling strangers who are in like manner led by a skillful official through the various floors of a factory, retire from the spectacle they present without having any feeling of sympathy excited by the cursory glance they have thrown over the silent unobtrusive little beings, one moment of whose unchanging existence they have been permitted to witness. It is the vast, the beautiful, the elaborate machinery by which they were surrounded that called forth all their attention, and all their wonder. The uniform ceaseless movement, sublime in its sturdy strength and unrelenting activity, drew every eye, and rapt the observer's mind in boundless admiration of the marvelous power of science! No wonder that along every line a score of noiseless children toiled, unthought-of, after the admirable machine. Strangers do not visit factories to look at them; it is the triumphant perfection of British mechanism which they come to see, it is of that they speak, of that they think, of that they boast when they leave the life-consuming process behind them. The more delicate, and

> (alas!) living springs by which the GREAT ARTIFICER has given movement to the beings made in his own image, are not worth a thought the while. The scientific speculator . . . gazes with enthusiasm and almost reverence on the myriads of whirling spindles amidst which they breathe their groans, unheeded, and unheard. (335)

The fact that this contextualization seems necessary in *Michael Armstrong* speaks to the prevalence of narratives of factory tours, like Sir George Head's, in which the "the marvelous power of science" and the "perfection of British mechanism" captures the tourist's attention, distracting the eye from the children working alongside the machine's "uniform ceaseless movement." It's no wonder that such tourists experienced industrial machinery as an encounter with the sublime, given that its scale, speed, and power were probably unlike anything they had previously encountered aside from the train—the other symbol of British's progress. However, by the time Mary visits the factory, she has already taken in Michael's brother Edward, and thus has direct knowledge of the effects the machinery on the workers' bodies. In contrast to the typical tourist which the narrator has described,

> it was not thus that Mary won her way through the whirling hissing world of machinery into which she now entered for the first time in her life. The hot and tainted atmosphere seemed to weigh upon her spirits, as well as upon her lungs . . . and the failing joints of Edward Armstrong became fearfully intelligible as she watched the children (and she watched nothing else) who dragged their attenuated limbs along. (336)

At this point in the novel, Mary has developed a properly sympathetic understanding and

paternalistic relationship with the Armstrong brothers, and so she enters the factory as an informed spectator. The novel does not try to offer a view of the machinery that is more realistic or in any way contrary to the sublime vision which most tourists were inclined to experience. Rather, we see modeled in Mary an educated tourist who knows that she should not look at the seductive, beautiful machinery, but should instead fix her gaze upon the children, as this is the only way to see how the machine affects the workers' bodies. The reader's gaze is aligned with Mary's, and like her we are only allowed to enter the factory after we have endured sufficient preparation in the form of numerous descriptions of damaged factory children's bodies.

The fact that readers were likely familiar with this sublime encounter with industrial machinery—either through narratives like Head's or Carlyle's, or from their own tourist experiences—was clearly something with which any critic of the factory system had to contend. Given the status of industrial machinery an awe-inspiring symbol of British progress, direct criticism of machinery seems out of the question. Like many other critiques of the factory system, *Michael Armstrong* contains the necessary clarification and admission that the novel certainly does not propose to do away with the machinery. In a discussion of political economy, Mary interjects, "I don't want to stop the mills, why should I? Industry, ingenuity, science, must of course be all brought into action by this flourishing cotton-trade, and, beyond all doubt, it would be equally wicked and wild to wish its destruction" (268). Mary's interlocutor, the wise Mr. Bell, reiterates the point later on: "Does legislature want to abolish machinery? . . . It is not the acquisition of any natural power, principle, or faculty, that we should deplore; all such, on the contrary should be hailed as part and parcel of our magnificent birthright . . . it is

not from increased, or increasing science that we have anything to dread, it is only from neglect of the moral power that should rule and regulate its uses that it can be other than one of God's best gifts" (294).

These problems with representing and critiquing the machinery were dealt with in *Michael Armstrong* and *Helen Fleetwood*, but their images of industrial machinery perhaps did more to introduce additional tensions into the novels than to correct their readers' misconceptions. Limited representationally to a technological sublime, and limited ideologically to the concession that industrial machinery was Britain's greatest achievement, depictions of child labor had to be carefully qualified, and readers had to be trained to look away.

The difficulties representing machinery displayed by both *Michael Armstrong* and *Helen Fleetwood* suggest that perhaps later industrial novels encountered similar ideological and representational problems, and rather than avoiding depictions of labor, they avoided descriptions of machinery by leaving their readers outside the factory doors. As this chapter has argued, the town and the country as spaces signaled the kinds of labor and social relations that dominated in each space. This metonymic relationship between town and machine suggests that in later industrial novels, the town and country opposition which readers generally dismiss as a formal failure perhaps contains and stands for the industrial machinery and mechanized labor process, which by necessity had to become an unrepresentable blank.

Chapter 4

Math and the Mechanical Mind:

Charles Babbage, Charles Dickens, and Mental Labor in *Little Dorrit*

According to Thomas Carlyle's well-known declaration in his 1829 essay "Signs of the Times," his was a lamentably mechanical age: "Were we required to characterise this age of ours by any single epithet, we should be tempted to call it, not a Heroical, Devotional, Philosophical, or Moral Age, but, above all others, the Mechanical Age. It is the Age of Machinery, in every outward and inward sense of that word" (6). Carlyle is not simply critiquing industrialization, but accuses society of becoming thoroughly mechanized to the extent that individuals internalize this impulse and are now "mechanical in head and in heart, as well as in hand" (9). Among numerous supposed causes of this mental mechanization, Carlyle accuses math:

> Mathematics, the highly prized exponent of all these other sciences, has also become more and more mechanical. Excellence in what is called its higher departments depends less on natural genius than on acquired expertness in wielding its machinery. Without undervaluing the wonderful results which a Lagrange or Laplace educes by means of it, we may remark, that their calculus, differential and integral, is little else than a more cunningly-constructed arithmetical mill; where the factors being put in, are, as it were, ground into the true product, under cover, and without other effort on our part than steady turning of the handle. (9)

These "higher departments" of calculus and algebra were in fact widely reviled in Britain

during the early decades of the nineteenth century for their allegedly detrimental effects on the mind of the student. Algebra's formulas and symbols not only cultivated mental laziness, but wreaked permanent psychic damage by installing mechanisms within the mind that converted it into a factory—"a more cunningly-constructed arithmetical mill"—motored by the logic of algebraical analysis. Whereas geometry was thought to discipline the mind to the practice of proceeding from first principles applied to empirical observations, algebra's reliance on symbolic language and abstract analysis seemed dangerous because it irreversibly mechanized the mind, ruining the student for the modes of inquiry pursued in other disciplines. Tapping into the nation's fear of the higher branches of math pursued on the continent, Carlyle claims algebra is one of the most insidious ways Britain's mechanical and industrial impulses infiltrated its people, making them internally "mechanical in head and in heart" (9).[1]

Charles Babbage, on the other hand, thought algebra's potential to mechanize, streamline, and maximize the mind's mathematical production made it an important mental tool specifically appropriate for accelerating the mathematical pursuits of geniuses. While Carlyle criticized math for turning the mind into a "cunningly-constructed arithmetical mill" (9), Babbage saw the advantages in the organizational parallels between early industrial factories and algebraic processes. Babbage's extensive work in mathematical theory and as the inventor of the Difference Engine—the first programmable computer—was far from unknown in Victorian Britain, especially after he

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[1] Carlyle continued his critique of mathematical thinking in *Latter-Day Pamphlets* (1850), particularly "Jesuitism," where he laments "That poor human symbols were higher than the God Almighty's facts they symbolised; that formulas, with or without the facts symbolised by them, were sacred and salutary; that formulas, well persisted in, could still save us when the facts were all fled!" and then rails against the "reverent or quasi-reverent faith in the dead human formulas, and somnolent contempt of the divine ever-living facts" (354, 359).

achieved national fame in 1832 with the publication of *On the Economy of Machinery and Manufactures*.[2] As a member of his social circle, Charles Dickens was certainly aware of Babbage's work, but followed his beloved mentor Carlyle's disapproving views on mathematics and mechanization.[3] Some indication of Dickens's opinion of the Difference Engine can be gleaned from a letter written in August, 1846, criticizing

> the gentle politico-economical principle that a surplus population must and ought to starve . . . . I am convinced that its philosophers would sink any government, any cause, any doctrine, even the most righteous. There is a sense and humanity in the mass, in the long run, that will not bear them; and they will wreck their friends always, as they wrecked them in the workings of the Poor-law-bill. Not all the figures that Babbage's calculating machine could turn up in twenty generations, would stand in the long run against the general heart. (qtd. in Forster 235)

For Dickens, Babbage's mathematical machine represents the bureaucratic machinery of an unfeeling government. His generalizing move to lump together economics, mechanization, and mathematics as utterly opposed to the "sense and humanity in the mass" is characteristic of his Carlylesque humanist and anti-economic ideals. He is

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[2] With his partially completed Difference Engine and later plans for an Analytical Engine, Babbage is credited with inventing what would have been the first computer. Though not the first to devise a mechanical calculator, his invention would have been the first that could be programmed.

[3] Herbert Sussman and Gerhard Joseph sum up evidence of Dickens's friendship and intellectual interest in Babbage: "Dickens not only owned a copy of Babbage's *Ninth Bridgewater Treatise* but also knew the author quite well. He attended Babbage's regular Sunday gatherings (*Letters* 2: 307) and invited Babbage to his own house for dinner parties (*Letters* 4: 134; 6: 113). They sat in the audience for worthy causes (*Letters* 3: 428n.) and corresponded about such controversial matters as the Corn Laws (*Letters* 2: 307), taxation (*Letters* 2:251), and the Society of Authors (*Letters* 3: 477). Dickens also visited the home of Babbage's champion, Ada Lovelace (*Letters* 3: 458)" (626, n.1). According to John Picker, Dickens read Babbage's *Ninth Bridgewater Treatise* carefully, referenced it in *Dombey and Son*, cited it in a speech in 1869, and, "Dickens's stated forecast of 'widest diffusion' for his works had an implicit model in Babbage's theory of vocal diffusion" (39).

disgusted with the cold, political economic doctrines that reduce the poor and the hungry to an abstract, faceless "surplus population," ignored by governments and allowed to suffer and die with a Malthusian inevitability.

Dickens's faith in the "general heart" and condemnation of government bureaucracy became central concerns in his novel *Little Dorrit* (1855-57). While critical attention to the novel generally focuses on its representation of speculative finance, the crucial role of math in this central plot element has yet to be taken seriously, as has the related mechanization of the characters most closely involved in the mathematical labors of industry, invention, and finance.[4] While it has become commonplace to observe that Babbage's efforts to secure government support for his Difference Engine are a likely source for the character Daniel Doyce's experiences with the Circumlocution Office, the novel in fact responds to Babbage's mathematical and mechanical work in ways much larger than critics have yet recognized.[5] Doyce is actually an amalgamation of Babbage and Babbage's theorization of a new class of professional inventors. Based in the prevalent assumptions that math—for better or for worse—inevitably mechanized the mind, Babbage proposed that algebra modeled a hierarchal division of labor that placed the genius inventor at the top, separating his supposedly self-directed, unalienated labor from the mechanized labor of those below him in the labor process. *Little Dorrit* revises this division of mental labor by transforming Babbage's personal conflicts with his partner Joseph Clement into the partnership between the genius Doyce and his

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[4] This financially-focused attention to *Little Dorrit* began with Jeff Nunokawa, whose work was highly influential in drawing critical interest to the economics of Victorian novels. Important contributions to this larger conversation who likewise center their readings of *Little Dorrit* on the speculation plot include Nancy Henry, Gail Turley Huston, Paul Jarvie, and Claudia Klaver.

[5] Jay Clayton's passing remarks about the Babbage-Doyce connection are typical (96).

mechanized accountant Arthur Clennam. The novel's representations of mental labor thus illuminate the ways Dickens as a novelist and Babbage as an inventor were similarly engaged with contemporary debates about mental labor, intellectual property, and the social utility of the professional. This essay's broadest concern is therefore to show how our current categorization of mental labor as uniquely productive of intellectual property derives from Victorian efforts to establish the mental labor of the professional as unalienated and self-directed through its opposition to the monotony, repetition, and supposed mindlessness of mechanical labor.

Part 1: Dickens and Babbage, Babbage and Doyce

While critics have remarked on Dickens's decades-long association and friendship with Babbage, we still lack close examinations of the influence Babbage's wide-ranging work in political economy, mathematics, and mechanical invention had on Dickens's literary production.[6] Before I go on to analyze Babbage's mathematical and economic writings, I want to first describe him as a major figure in London society, whose unique and vibrant personality offers one among many links to the character

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[6] While Babbage has become a familiar figure in Victorianist literary and cultural studies, critics fail to adequately historicize his writings, and are more likely to project their own critical agenda onto his texts than to take Babbage at his own word. Sussman and Joseph's hasty assessment of the creative interchange between Dickens and Babbage is typical in its ahistorical recognition of a range of post-modern concepts concerning the human machine relation: "the oscillation in Dickens's work between representing characters as self-acting 'things' and as 'people,' (i.e., as nineteenth-century liberal subjects moved by ethical will), registers a Victorian discursive practice wherein the boundary between the machine and the human tends to dissolve. His novels record the puzzlement he shared with his time about the distinction between the animate and the inanimate. Babbage, for one, imagined his Difference Engine as a form of intelligent life, felt he was communicating with an entity endowed with mind. . . . Dickens's novels reflect his own uncertainty about the living machine, both in the sense of the new self-acting machines as 'living' and in the reciprocal sense of human beings sharing this ambiguous state of self-acting machines fusing the mechanical and the animate. In negotiating the machine/body issues of his age by representing in fantastical terms the splice of the machine and the organic, Dickens's novels occupy an important place in the historical transformation of the human into what has become known as the 'posthuman'" (618).

Doyce from *Little Dorrit*. In 1828 Babbage purchased his London home at Dorset Street and began cultivating his reputation as a celebrated host. Dickens was often among the guests at Babbage's evening meetings, which became a highlight of the London social season and, as described by friend and fellow scientist Charles Lyell, were "very brilliantly attended by fashionable ladies, as well as literary and scientific gents, and where one meets with persons high in all professions, and with distinguished foreigners" (466). While Babbage enjoyed talking on a number of subjects, he was particularly eager to discuss science and explain his inventions and ideas to anyone who would listen. He proudly displayed the unfinished Difference Engine in his home (alongside his dancing lady automaton) as a prompt to visitors' inquiries and discussion of the thwarted invention. Harriet Martineau, another frequent guest, remarks, "All were eager to go to his glorious soirées; and I always thought he appeared to great advantage as a host. His patience in explaining his machine in those days was really exemplary. I felt so, the first time I saw the miracle, as it appeared to me" (271).

Despite his out-going and affable personality, Martineau recalls that "few men were more misunderstood" (270). Babbage was known for his somewhat odd personality, which Dickens made a decided effort to capture with his character Doyce. Lyell describes a particular evening:

> We have had great fun in laughing at Babbage, who unconsciously jokes and reasons in high mathematics, talks of the "algebraic equation" of such a one's character, in regard to the truth of his stories, &c. I remarked that the paint of Fitton's house would not stand, on which Babbage said, "No; painting a house outside is calculating by the Index minus one," or some

> such phrase, which made us stare; so that he said gravely, by way of explanation, "That is to say, I am assuming *revenue* to be a *function*." All this without pedantry, and he bears being well quizzed for it. (363-64, original emphases)

Like Babbage, Doyce makes obscure mathematical jokes and is often the only one in the room who knows what he is talking about, typically saying things like, "But you know we always make an allowance for friction, and so I have reserved space to close in" (784; bk 2; ch 34). But Doyce is aware that his mathematical humor is generally impenetrable to listeners, and often seems to talk to himself for his own entertainment: "'In my calling,' said Daniel, amused, 'the greater usually includes the less. But never mind, never mind! Whatever pleases you, pleases me'" (195; bk 1; ch 16). While Doyce is glad to socialize, he is always immersed in "some mental combinations he had been making," usually "either sitting out like an amused spectator at cards, or coming in with some shrewd little experiences of his own, when it happened to be to the purpose" (190, 196; bk 1; ch 16). But far from "laughing at Babbage," as Lyell did, Dickens is kind in his presentation of Doyce as a more well-adjusted version of Babbage. Doyce has a better understanding and acceptance of his difference from those around him, and is thus less likely to find himself in hurtful moments of failed communication or rejection. In a potential reference to what Lyell describes as Babbage's "algebraic" analysis of character, Doyce understands other people as acting on scientifically predictable principles: "as I know what such a metal will do at such a temperature, and such a body under such a pressure, so I may know (if I will only consider), how these great lords and gentlemen will certainly deal with such a matter as mine" (127; bk 1; ch 10). While this

method protects Doyce in social situations, Babbage's mathematical approach actually caused him much pain. As Martineau describes,

> he collected every thing he could gather in print about himself, and pasted the pieces into a large book, with the *pros* and *cons* in parallel columns, from which he obtained a sort of balance, besides some highly curious observations. Soon after he told me this, with fun and good humour, I was told repeatedly that he spent all his days in gloating and grumbling over what people said of him, having got it all down in a book, which he was perpetually poring over. (271)

The parallel between Doyce and Babbage was first recognized by Anthony Hyman, and following his lead readers of *Little Dorrit* often point out that Babbage's fruitless efforts to secure government funding for his Difference Engine offer a source for Doyce's very similar problems with the Circumlocution Office.[7] Babbage's life was indeed consumed by his struggles with Parliament over his Difference Engine, which he began following a dispute with his head engineer, Joseph Clement. When Babbage initiated the project of building the Engine in 1823, he made a series of drawings and plans and put Clement in charge of building them while Babbage spent the next two years abroad.[8] The elaborate Engine required Clement to make a large number of specialty

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[7] The following overview of Babbage's efforts to gain funding for the Difference Engine is heavily indebted to Anthony Hyman's detailed and careful study of Babbage and to Babbage's autobiography, *Passages from the Life of a Philosopher*. On the parallels to Daniel Doyce and the Circumlocution Office, Hyman writes, "It would be unreasonable to suggest that Babbage's experience was the sole source of inspiration . . . but certainly the treatment of Babbage for daring to develop a calculating engine was a primary inspiration" (193-94). Other scholars who don't point to Babbage, still feel Doyce must have been based on *someone*: John Lucas argues that Dickens intended Doyce as "an amalgam of Carlyle's ideal poet and Ruskin's thinking-worker" (279). Janet Larson agrees, emphasizing his Carlylean origins (162).

[8] Hyman explains, "Clement was a highly skilled mechanic but had not previously been responsible for so large a project. Before leaving England, Babbage was already worried that Clement was

tools, unique to the construction of this project, and without which the Engine could not be reproduced. While craft tradition held that all tools remained the property of their maker and user, this custom was inadequate in the case of the specialized lathes and machine tools required for the Difference Engine.[9] Babbage and Clement fought over ownership of these tools, and their conflict came to a head in 1832 when Babbage refused to pay Clement's bills, forcing him to fire the entire staff of workers employed in building the Engine, and then demanded that the still unfinished machine be removed from Clement's workshop. Babbage attempted to resolve these property disputes by petitioning the government to take over ownership of the Engine and pay for its completion, a process that continued for the next two decades. Babbage did gain some small successes on this front, but never received enough funding to finish the project, and in 1852 received a final, decisive denial from Disraeli. While Babbage's struggles with Parliament were over financial resources, his constant source of frustration concerned their repeated failure to understand that the Engine deserved government funding because it could make a major contribution to the nation. Hyman explains, "The Difference Engine was by no means the only project which was to run into difficulty and exceed its estimated cost. But where other projects could point to immediate public utility, it required considerable knowledge and intellectual effort to comprehend the significance of the Difference Engine" (56).[10]

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less than straightforward, suspecting him of developing and constructing at his employer's cost special lathes and other tools valuable in constructing the Difference Engine but intended to remain in Clement's workshop" (122).

[9] As Hyman explains, "There was no point in Babbage's arguing whether or not the tools had been constructed during working hours. Even if that could be proved, all the novel and ingenious machine-tools, even though they had been developed at Babbage's instigation, belonged to Clement" (125).

[10] The Difference Engine's function was to calculate tables, and it promised to save great deal of time, energy, and money in the cost of labor, in addition to offering increased reliability and accuracy. In

Doyce also "perfects an invention (involving a very curious secret process) of great importance to his country and his fellow-creatures. I won't say how much money it cost him, or how many years of his life he had been about it, but he brought it to perfection a dozen years ago" (124; bk. 1; ch 10).[11] Doyce's struggles with the Circumlocution Office center on his difficulty penetrating government bureaucracy; he never states any intention beyond the simple desire to forge a line of progress and communication. The biting critique behind the Circumlocution Office lies in Dickens's frustration with bureaucratic red tape, which he felt had all but consumed the British government, manifesting most dangerously in the utter mismanagement of the Crimean War.[12] With the primary goal of preventing all comers from getting anything accomplished, "the Circumlocution Office went on mechanically, every day, keeping this wonderful, all-sufficient wheel of statesmanship, How not to do it, in motion" (111; bk 1; ch 10).[13] Thus committed to "not doing it," the Office constantly treats Doyce like "a public offender" for merely attempting to get something done, despite the fact that his intentions are entirely selfless: "he has been trying to turn his ingenuity to his country's

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Babbage's time these long and extensive tables of figures were necessary for many fields, primarily navigation which required volumes of astronomical tables. Multi-volume sets of tables had been published but contained numerous errors. As Babbage's colleague Dionysus Lardner wrote in an article for the *Edinburgh Review* in an effort to explain the Difference Engine to a lay audience: "The surveyor, the architect, the builder, the carpenter, the miner, the gauger, the naval architect, the engineer, civil and military, all require the aid of peculiar numerical tables, and such have been published in all countries"; however, "the existing supply of tables, vast as it certainly is, is still scanty, and utterly inadequate to the demands of the community" (269; 283).

11 Julian Markels argues that "Dickens won't tell us specifically what Doyce's work entails because he wants to confine our attention to Doyce's devotion to labor and invention for their own sake. This focus is then sharpened by Dickens's parallel idealization of Little Dorrit throughout the novel" (42). I agree with Markles's point that Doyce's selflessness is central to his character, but I also recognize the problems Dickens would have produced for himself in trying to invent an invention for Doyce, not the least of which would be the difficulty of hitting upon an idea that readers would find useful, ingenious, and laudatory, though not entirely preposterous, fantastical, or frivolous.

12 See also Dickens's Carlylesque raillery against "Red Tapeosophy" and "the Right Honorable Red Tape, M.P." in his short piece called "Red Tape" in *Household Words* (15 Feb. 1851).

13 See Ruth Bernard Yeazell's article "Do It or Dorrit" for a discussion of "doing it" in the novel.

service . . . to effect a great saving and a great improvement" (124-25; bk 1; ch 10). Critics usually interpret Doyce's calm persistence to return, time and again, to the Circumlocution Office as a sign of his nationalism, but I suggest this is better explained as an aspect of his character as a scientifically-minded inventor.[14] While Babbage had clear financial reasons for professing a selfless desire to benefit his country, Doyce is genuinely motivated by the invention itself and the incontrovertible fact that "The thing is as true as it ever was" (190; bk 1; ch 16). As he explains to Clennam, an invention is "not put into his head to be buried. It's put into his head to be made useful. You hold your life on the condition that to the last you shall struggle hard for it. Every man holds a discovery on the same terms" (190-91; bk 1; ch 16). Doyce is never motivated by economic gains or the allure of fame, but persists with "a calm knowledge that what was true must remain true" (192; bk 1; ch 16).

Doyce's problems with the Circumlocution Office are usually interpreted in light of Dickens's commentary on debates about patent law reform.[15] However, as Trey

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[14] We are told, for example, that "he had naturally felt a preference for his own country, and a wish to gain distinction there, and to do whatever service he could do, there rather than elsewhere" (190; bk 1; ch 16). These scattered remarks have been overemphasized by critics like Amanda Anderson, when in fact their primary function is in Dickens's critique of government bureaucracy. The Circumlocution Office created problems for inventors that are specific to England: "When they take their inventions into foreign countries, that's quite different. And that's the reason why so many go there" (126; bk 1; ch 10). Doyce is lured away from his native land by "a certain barbaric Power with valuable possessions on the map of the world, [which] had occasion for the services of one or two engineers, quick in invention and determined in execution" (643; bk 2; ch 22). The fact that Doyce's powers of mechanical genius are eventually used by Russia only emphasizes the link between the Circumlocution office and Dickens's critique of the British government's bungling of the Crimean War, which, given the back dating of the novel, is exactly the "occasion" for which they would need the service of an engineer like Doyce. When he returns at the end of the novel, Meagles explains that, "Dan is directing works and executing labours over yonder, that it would make your hair stand on end to look at. He's no public offender, bless you, now! He's medalled and ribboned, and starred and crossed, and I don't-know-what all'd, like a born nobleman. But . . . he must hide all those things under lock and key when he comes over here. . . . Britannia . . . won't give her children such distinctions herself, and won't allow them to be seen when they are given by other countries" (782-83; bk 2; ch 34). In Babbage's *Economy* he rails against England's prohibition against inventors and engineers traveling to other countries.

[15] Clare Pettit states, "As in 'A Poor Man's Tale of a Patent', Dickens deflects class antagonism

Philpots has pointed out, the novel never even uses the word "patent," and by the time of its publication Dickens's earlier opinion on the patent debate had evolved from that expressed in his 1851 story "A Poor Man's Tale of a Patent."[16] Rather than offering a very specific comment on the patent issue, *Little Dorrit* engages much larger questions about mental labor, intellectual property, and the figure of the professional. This becomes apparent if we see Doyce as based not only on Babbage's personality and experiences, but also as a representation of the idealized figure of the inventor genius theorized in his mathematical and political economic work. As he declared in *On the Economy of Machinery and Manufactures*, "It is highly probable that in the next generation, the race of scientific men in England will spring from a class of persons altogether different from that which has hitherto scantily supplied them" (384). Unlike the university-educated elite, he claims, "the sons of our wealthy manufacturers" will benefit from the combination of education and a thorough familiarity with the current mechanical strengths and needs of British industry (384). As he argued in *Reflections on the Decline of Science in England* (1830), the slow advance of British science was centrally related to the fact that "there exists no particular class professedly devoted to science" and that "the pursuit of science does not, in England, constitute a distinct profession, as it does in many other countries. It is therefore, on that ground alone, deprived of many of the advantages which attach to professions" (10-11). The advance of science was for Babbage thus

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from Doyce himself, who remains untainted by self-interest or radicalism"; "Doyce is not based on a person, but on a debate—the patent and copyright debates, to be precise" (192; 196).

16 According to Philpots, "Evidence in *Household Words* suggests that by at least 1853 Dickens had second-thoughts about patent reform and had begun to concur with the small group of engineers, manufacturers, and economists who wanted to abolish the patent system altogether. . . . [T]he technical issue of patent reform, mostly of interest to a few inventors, would have become subsumed by a larger question: why are these important inventions not being used? And if England fails to use them, what other country will? When Doyce observes that matters are 'quite different' in foreign countries, he is voicing common fears, not obsolete ones of 1852" (158, 166).

crucially related to the attainment of class-based privilege achieved by a group uniquely formed by their mixed class origins.

Doyce does not benefit from any economic privilege, but attains his status as a professional by spending approximately thirty years cultivating his knowledge and skill in engineering as a manual laborer: "he was the son of a north-country blacksmith"; he completed an apprenticeship with a lock-maker; he began a new apprenticeship with a working engineer "under whom he had laboured hard, learned hard, and lived hard, seven years"; following this he "worked in the shop" for seven or eight more years; and after relocating he "studied, and filed, and hammered, and improved his knowledge, theoretical and practical, for six or seven years more" (190; bk 1; ch 16). While Doyce is no longer a manual laborer, now a factory owner who directs the labors of others, his abilities as an inventor derive directly from his hands-on experience using machines and tools. His history as a mechanic is also the underlying factor explaining all of his peculiarities: "He spoke in that quiet deliberate manner, and in that undertone, which is often observable in mechanics who consider and adjust with great nicety. It belonged to him like his suppleness of thumb, or his peculiar way of tilting up his hat at the back every now and then, as if he were contemplating some half-finished work of his hand and thinking about it" (126; bk 1; ch 10).[17] The novel makes repeated references to Doyce's active thumbs, and his "certain free use of the thumb that is never seen but in a hand accustomed to tools" constantly marks him as a manual laborer—as his workmen say, "a

[17] While Babbage delighted in talking about his machine to anyone who would listen, he lacked the mechanical skill of a working engineer, which enables Doyce to successfully explain his mechanical work to an audience of non-experts: "He had the power, often to be found in union with such a character, of explaining what he himself perceived, and meant, with the direct force and distinctness with which it struck his own mind. His manner of demonstration was so orderly and neat and simple, that it was not easy to mistake him" (495-96; bk 2; ch 8).

man as knows his tools and as his tools knows" (123; bk 1; ch 10, 646; bk 2; ch 22).

While he clearly has an inventor's mental genius, Doyce's "plastic workman's thumb" is crucial to his abilities as a creator and foregrounds the fact that the work of invention unites mental and manual labors, an important parallel to the new class of inventor that Babbage proposed would emerge from the educated sons of the nation's manufacturers (644; bk 2; ch 22).[18] The complex class locations and the tenuous relations between mental and manual labor that mark both Doyce and Babbage's inventor clearly link them to the emerging figure of the professional, as well as to Dickens's and Babbage's participation in the cultural construction of this figure. As Clare Pettit explains, in the first half of the nineteenth century fiction writers and inventors alike "were attempting to transcend their mixed class origins and to form themselves as professions, and both were seeking recognition from the state" (155). This state recognition meant copyright and patent protections, and writers and inventors, including Dickens and Babbage, often worked together on their respective campaigns.[19] At this time when the category of mental labor was being hotly debated, this collaboration enabled writers and inventers to capitalize on similarities between their mental labors as both acts of creation whose products had social use value. These reform campaigns, Pettit explains, facilitated "in drawing together and defining the professions of writing and engineering at a time when the ownership and social status of such 'new' forms of labour

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18 The *Oxford English Dictionary* gives the following definition for "plastic" as an adjective: "That moulds. Characterized by or capable of moulding or shaping clay, wax, or other soft or formless materials."

19 On Dickens's participation in the Author's Society and other copyright organizations, see Poovey (112-13), Pettit (185), and Hyman (203-04).

was—indeed—uncertain and fluid" (79-80).[20] According to Jennifer Ruth, the tenuous nature of the new professional identity stemmed from its "contradictory class locations":

> How, then, to account for professionals who perform labor but also possess a kind of capital (mental capital in the form of measurable talent and the stored labor of knowledge acquisition)? The nascent professional also confounded assumptions about the relationship between economic and *social* class: if he did not look or act like a wage laborer, he nevertheless relied upon a wage or salary; if he did not possess financial capital (though he had to have *some* to embark on a professional career), he claimed what we would now call cultural capital. (4, original emphases)[21]

Attainment of the new social identity of the professional was crucially tied to establishing the social utility and use value of the products of mental labor, while constructing this mental labor as categorically distinct from the manual labors usually associated with

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[20] Pettit characterizes early-nineteenth-century category of mental labor as "uncertain and fluid": "The nineteenth century represents a critical period in the history of the debate about mental labour. How far to men and women 'enter into' their labours? How far should that trace of their identity of corporeality be rewarded financially? And how long before that trace fades away and allows the invention—be it literary of mechanical—to revert to the possession of the general culture?" (1). She goes on to explain that "for writers and inventors in the early nineteenth century, it was crucial that the law held out a promise of future value for their inventions, as only such an investment in futurity could mark them out as different from 'common labourers' who sold their work on a daily basis" (3).

[21] Ruth's major debt is to Mary Poovey's work on the mental labor of the Victorian novelist in *Uneven Developments*: "Because it was conceptualized simultaneously as superior to the capitalist economy and as hopelessly embroiled within it, literary work was the work par excellence that denied *and* exemplified the alienation written into capitalist work" (106). Ruth: "Poovey complains that Dickens's depiction of David's writing and Agnes's housekeeping 'convey[s] the twin impressions that some kinds of work are less 'degrading' and less alienating than others and that some laborers are so selfless and skilled that to them work is simultaneously an expression of self and a gift to others. . . . If one agrees with Poovey that the logic of market relations informs every pursuit in one way or another, does that necessarily mean all labor is equally alienated? . . . Relatively autonomous cultural production does not rely primarily upon individual exceptionalism but is built into institutions and dispositions over the course of a century. And the vocational disposition, in circular fashion, depended on the development of institutions organized so as to cultivate in its members a pleasure in holding the market at arm's length. All work under capitalism is certainly implicated in capitalism's logic of equivalence, but that does not mean all work is equal" (22-23).

material production. Inventors and fiction writers alike had high stakes in these debates as they struggled to establish for themselves public roles as valued professionals whose labor was sharply distinguished from the mechanized wage laborer.[22]

I will extend the work of Pettit and Ruth to show that with this emerging figure of the professional also emerges the construction of a hierarchical division of labor that separates the mental labor of the genius inventor from the increasingly mechanized labors of every other worker below him. This division of labor enables the ideological construction of the categories of mental and manual labor as mutually exclusive, and allows the professional's labor to be defined as non-alienated and directed by innate genius through an opposition to the supposedly mindless mechanization of the manual laborer. Through an analysis of Babbage's mathematical theory, political economy, and his invention of the Difference Engine, I will next examine Babbage's participation in these debates about professional labor and intellectual property through his imagined new class of inventor, which would later form the other component of Doyce's character.

Part 2: Babbage and the Mathematical Mind

Babbage's proposal that a new class of inventor would emerge in Britain was based on his theorization of a division of labor modeled on algebra. This work began with his earliest writings which defended algebra against the firm belief, widely held in Britain in the early decades of the nineteenth century, that the higher forms of math were dangerous because they mechanized the mind of the student. In his autobiography,

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[22] Ruth explains the ideological stakes of the professional for a capitalist society: "The professions enable capitalism by falsely holding out the promise of unalienated labor to everyone. Yet they also destabilize it because by holding out the promise of gratifying work, they remind us that work should be gratifying" (22-23).

Passages from the Life of a Philosopher, Babbage records his shock and disappointment upon arriving at Cambridge University as a young student only to find his math tutors profoundly ignorant of the problems in algebra and calculus with which he had eagerly anticipated their assistance (26-27). To his surprise, he had already surpassed them in his studies of Leibnitz, Lagrange, and Laplace, and was confused by the ill repute with which Cambridge academics regarded the continental mathematicians. As historian of mathematics J. M. Dubbey remarks, in the early decades of the nineteenth century "British mathematicians were riddled by irrational prejudice, unhealthy conservatism in choice of method and notation, cut off from their Continental contemporaries, and uneasy about unsettled internal disputes" (13).[23] Upon encountering this resistance Babbage found ways to continue pursuing his interest in math by joining with other "radical" students, including John Herschel, to form the Analytical Society. As Babbage contentedly recalls, "Of course we were much ridiculed by the Dons; and, being put down, it was darkly hinted that we were young infidels, and that no good would come of us" (*Passages* 29).

In this environment where mathematical thinking was met with resounding doubt and fear, writers engaged in explaining and advocating for algebraical analysis generally proceeded by countering these prejudices with the argument that algebra's symbolic

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[23] The British universities' resistance to algebra stems from the quarrel and resulting accusations of plagiarism between Newton and Leibniz over who developed calculus. As a result of national loyalty to Newton, British mathematicians were trained exclusively in Newtonian notation, which caused them to lag behind continental advancements, unable even to read their different style of notation. Moreover, in the decades following the French Revolution and during the wars with France, it was impossible for any expression of interest in French science to be interpreted apolitically, especially in the conservative university environment. In this context, it makes sense that Babbage's student cohorts seemed radical; as Hyman explains, "as a result of the long-lasting Newton-against-Leibniz controversy and the primacy of French science, the question of the choice of mathematical notation improbably acquired political overtones" (23). On the political causes of the stunting of early-nineteenth-century British mathematics, see Hyman (20-30) and Dubbey (10-30).

language is immensely superior and useful as a mental tool.[24] In Babbage's work this position was first articulated in 1813 when he co-authored with Hershel the Analytical Society's only publication, the *Memoirs of the Analytical Society*. In its preface Babbage launches a compelling and forthright argument for the usefulness of algebraical analysis as an "instrument of reason" based primarily on "the accurate simplicity of its language" (i). The symbolic communication which algebra enables is superior, he claims, because it omits the ambiguity and multiplicity of meaning unavoidable in language: "An arbitrary symbol can neither convey, nor excite any idea foreign to its original definition" (i). In addition, symbolic language is considerably abbreviated: it allows the mind to comprehend in a single formula the whole of a problem, whereas without the substitution of symbols the mind would be forced to continually move from component to component, constantly making an effort to re-familiarize itself with each part, and yet never able to grasp them simultaneously as a whole. Thus,

> It is the spirit of this symbolic language, by that mechanical tact, (so much in unison with all our faculties,) which carries the eye at one glance through the most intricate modifications of quantity, to condense pages into lines, and volumes into pages; shortening the road to discovery, and preserving the mind unfatigued by continued efforts of attention to the minor parts, that it may exert its whole vigor on those which are more important. (i-ii)

Babbage's claim that the "mechanical tact"—the swiftness and delicacy of skill—

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[24] Dubbey explains the distinction between arithmetical and symbolic algebra: previously algebra had been considered only as arithmetical, with letters and symbols replacing the numbers. Algebra may be defined to be the science of general reasoning by symbolic language (100).

afforded by algebra is "so much in unison with all our faculties" as they naturally are, anticipates his later need to refute arguments that this aid to mental processes in fact altered the operation of the mind by damagingly heightening particular faculties while dulling others.

These arguments advocating the mental benefits of algebraical analysis were also being advanced by Dugald Stewart, and we know that while at Cambridge Babbage was heavily influenced by Stewart's *Elements of the Philosophy of the Human Mind* (vol. 1, 1792; vol. 2, 1814; vol. 3 1827).[25] In the first of Stewart's three massive volumes on the operations of the mind, he develops an "analogy between the mechanical arts and the operations of scientific invention" in order to propose that, just as "the natural powers of man have been assisted by the use of tools and instruments," mechanisms can similarly be devised as "aids to our intellectual faculties" (1: 82). He finds proof of the potential and power of such mental tools in "the wonderful effects of Algebra" (1: 82). For Stewart, as for Babbage, the primary benefit of algebra is the precision and efficiency afforded by its purely symbolic language.

> In [algebra], where the use of an ambiguous word is impossible, it may be easily conceived how the solution of a problem may be reduced to something resembling the operations of a mill—the conditions of the problem, when once translated from the common language into that of

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[25] In his autobiography Babbage records his later friendship with Stewart and states the early influence of his work: "The second volume of his 'Philosophy of the Human Mind' had fortunately fallen into my hands at an early period during my residence at Cambridge, and I had derived much useful instruction from that valuable work" (474). Babbage's biographer H. W. Buxton further remarks, "At an early period of life Mr. Babbage became fascinated by the genius of Dugald Stewart, and an intimacy which was at first the result of accident, finally ripened into a warm and lasting friendship. It is true that Mr. Babbage was never strongly attracted towards metaphysical investigation . . . . But it was principally as a mathematician that Dugald Stewart was known to him" (350).

> algebra, disappearing entirely from the view; and the subsequent process being almost mechanically regulated by general rules, till the final result is obtained. (2: 106)

Stewart's imagery here, comparing the mental labor of math to "the operations of a mill," perhaps provided Babbage with an early suggestion of the similarity between algebraic analysis and the mechanical organization of an industrial factory. This analogy becomes instrumental in Babbage's later arguments legitimizing algebra, which follow Stewart in aligning its productive possibilities with the same capitalist ideology that directed the rationalization of early industrial factories. These images and comparisons align the goals of mathematical production with the goals of economic productivism enacted by early-nineteenth-century industrial mills and mechanization of the labor process. Stewart's recourse to capitalist ideologies of efficiency are evident in his metaphors, as he draws upon thinkers like Leibniz in arguing that as algebra avoids the indeterminacy of language it thus enables the mental labors of math to be "almost mechanically regulated by general rules," terms meant to indicate that algebra is a scientific advancement that can be evaluated by the same increase in economic efficiency and productivity that—according to productivist and technological determinist ideologies—measured advancements in the industrial labor process.

Just as the primary innovation of the early industrial factory was to reorganize laborers, materials, equipment, and management into a shared space, Babbage saw the efficiency and productivity afforded by algebraical reasoning as similarly a matter of spatial reorganization. In his later work *On the Influence of Signs in Mathematical Reasoning* (1826), he writes of the mental efficiency afforded by algebra in terms of

spatial economy: "The quantity of meaning compressed into small space by algebraic signs is another circumstance that facilitates the reasonings we are accustomed to carry on by their aid" (6). Algebraical language thus "present[s] to the eye a picture perfect in all its parts, disclosing at a glance, not merely the conclusion in which it terminated, but every stage of its progress" (6-7). As a result of this "triumph of signs over words," Babbage claims, "The closer the succession between two ideas which the mind compares, provided those ideas are clearly perceived, the more accurate will be the judgment that results; and the rapidity of forming this judgment, which is a matter of great importance" (7-8). For Babbage, algebra enabled the mind to become a more efficient producer of mathematical knowledge: translating language into symbols and organizing these symbols into formulae streamlined mental production, enabling the mind to comprehend more information "at a glance" and thus accelerating Britain's advancements in mathematical and scientific knowledge. While Babbage thought algebra should be celebrated for turning the mind into an efficient, precise, and productive machine, he was also sadly aware that "The almost mechanical nature of many of the operations of Algebra, which certainly contributes greatly to its power, has been strangely misunderstood by some who have even regarded it as a defect" (9).[26]

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[26] William Ashworth reads Babbage's early writings as evidence that Babbage and Herschel set out to industrialize the mind and arrived at algebra with this intention, arguing that "Herschel and Babbage's stress on systematization and economizing mental labor had led them to Lagrange's algebraic calculus. As we have seen, with its emphasis on abbreviation, symmetry, and unity, Lagrangian calculus sat well with their industrial agenda" (). Mine is a more biographical argument in recognizing that Babbage was first interested in math; that he was engaging in pre-existing rhetoric about its educational benefits and dangers; and that it was not until after he left Cambridge and started work on his Engines that he began to tour factories to learn more about machinery. In his earlier recommendations for the benefits of algebra, Babbage engages in arguments for its benefits by endorsing the increased productivity, and thereby does exhibit the internalization of capitalist ideologies of efficiency. However, it is not until his *Economy*, and as a result of his industrial tours, that he fully applied algebra's mental effects to the division of mental labor and saw in de Prony that the organization of a factory could be applied to mathematical laborers as well. I do not go as far as Ashworth in claiming that Babbage's earliest and foremost intention was to mechanize

This conservative misunderstanding was based in fears that, as a result of algebra's supposedly permanent restructuring of the mind, other mental faculties would become dulled or diminished in the process. In the early decades of the nineteenth century it was an agreed upon truth that long and concentrated use of symbolic language failed to stimulate and in fact tended to weaken other powers of the mind. As Stewart acknowledges,

> considered either as an instrument of thought, or as a medium of communication with others, [algebra] consists in the use of expressions, which, from their generality, have no tendency to awaken the powers of conception and imagination. . . . And hence the effects which long habits of philosophical speculation have in weakening, by disuse, those faculties of the mind which are necessary for the exertions of the poet and the orator, and of gradually forming a style of composition, which they who read merely for amusement, are apt to censure for a want of vivacity and of ornament. (2: 181-82)

In his separation of mathematical thought and "philosophical speculation," on the one hand, from "conception," "imagination," and "the exertions of the poet and orator," on the other, Stewart recapitulates the division of mental faculties generally relied upon by algebra's conservative detractors. For Stewart, the dulling of the mind's poetic faculties was no real loss compared to the cultivation of a philosophical mind skilled in the "operations of scientific invention." While advocates like Stewart and Babbage thought the mental advancements of algebra could produce a new, professional class formed to be

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the mind.

the nation's inventors, the fact of the matter was that Cambridge was in the business of producing cultured elites, not professional inventors.[27]

In debates over the place of math in university curricula, therefore, the specific effects of algebra on the mind and the intended purpose of an elite education were not separate issues. Conservatives like William Whewell argued that algebra ruined exactly those parts of the brain a university education was designed to cultivate. In his 1835 pamphlet "Thoughts on the Study of Mathematics as a Part of a Liberal Education," Whewell criticizes algebra for deadening the mind's receptivity to culture and moral cultivation: "a person inured to mathematical reasoning alone, reasons ill on other subjects, seeks in them a kind and degree of proof which does not belong to them, becomes insensible to moral evidence, and loses those finer perceptions of fitness and beauty, in which propriety of action and delicacy of taste must have their origin" (143).[28] Whereas algebra allowed lazy students to proceed from assumed principles, a liberal education's purpose of teaching students to reason from first principles had a profoundly moral function: "The object of a *liberal education* is to develop the whole mental system

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[27] As Dubbey remarks, "The feeling that mathematics was only a charade, a useful exercise for sharpening the wits, prevailed with few exceptions" (14). He explains that at this time Cambridge was not a research center, besides which the state of mathematical research was such in England that "There was very little possibility of a professional career in mathematics" (20); "We may conclude that mathematics teaching was by no means neglected at universities during this period, especially at Cambridge and in Scotland, but there is no indication of these places being centres of research, and little to suggest that they were in a position to stimulate progress which compared with that being made on the Continent" (23-24).

[28] Whewell reprinted his pamphlet as an appendix to *On the Principles of English University Education* (1835), and later extended the arguments in *Of a Liberal Education in General and with Particular References to the Leading Studies of the University of Cambridge* (1845). In the later publication, Whewell developed the common comparison between algebra and geometry to argue that, while geometry is preferable for teaching students to reason from first principles, algebra is too advanced for university students and an inappropriate substitute for geometry. He was concerned that "Analysis, pursued without a proper geometrical and arithmetical foundation, has in it no clearness or light. The student who is led on in such a course, is immersed in a mist of symbols, in which he only here and there sees a dim twilight of meaning" (54-55). Whereas in "geometrical reasoning, we tread the ground ourselves, at every step feeling ourselves firm, and directing our steps to the end aimed at," in "analytical calculation, we are carried along as in a rail-road carriage . . . without having any choice in our progress in the intermediate space" (41).

of man, and thus to bring it into consistency with itself;—to make his speculative inferences coincide with his practical convictions;—to enable him to render a reason for the belief that is in him" (144, original emphasis). Whewell feared that once the mechanisms of algebra had been installed in the mind, the student would no longer reason from first principles, an ability which elevates the young student above the uneducated: "Nothing is more common than to hear people urge very foolish arguments in support of very just opinions; and what has been said of women is often no less true of the sex which pretends to have the more logical kind of head:—namely, that if they give their judgment only, they are not unlikely to be right, but if they add their reasons for it, those will most probably be wrong" (144). Algebra's abbreviated, condensed method of thinking was, according to Whewell, characteristic of women and the uneducated—the exact mode of thinking an elite education was designed to eliminate.

Whewell thus argued against precisely those aspects of algebraic thinking which Babbage championed as scientific advancements. Moreover, Babbage's claim that algebra allowed the mind to increase its productivity by rationalizing it like a factory, placed mathematical thinking squarely in a realm of economic production and professional labor, also distinctly inappropriate for Whewell's elite students. While these mental mechanisms were perhaps undesirable for the nation's elite, Babbage remarked that, as a mental tool, algebra enabled the surmounting of the specifically mental obstacles that had stifled British progress in science and invention, potentially enabling "the discovery of a philosophical theory of invention" (*Memoirs* xxi). While he blames this partially on the failures of the British educational system, he also claims that invention requires "in its author not merely a complete knowledge of the mathematical

science of his age, but a genius to enlarge its boundaries by his new creations of his own," thus clearing the way for a class of inventor geniuses pre-selected by their innate ability, and thus not necessarily deriving from the elite who had access to Whewell's liberal education (17).

Part 3: Invention, Engines, and the Division of Labor

Babbage theorized that algebraical thinking could revitalize scientific invention in Britain because he saw algebra as not only enabling the division of mental labor, but as the scientific principle behind this social relation. When algebra condenses a given problem by translating it into symbols and formulae, thus disburdening the mind of the inventor, this enables a division of labor wherein the inventor is allowed to focus on constructing formulae, while the tedious process of applying the formulae and churning out tables of results is relegated to another group of workers whose labor is de-skilled and de-valued. Babbage's proposal that algebra could transform British invention is thus based on his notion that algebra turned math into a capitalist labor process made increasingly productive and efficient through the same division of labor, deskilling, and mechanization that he would later observe in the still developing industrial scene. Critical assessments of Babbage have generated much confusion over the direction of influence and the chronological order in which he theorized algebraical thinking and developed his knowledge of industrial factories.[29] It is clear that even before he developed his

[29] Zimmerman's study of Babbage aims to understand how he was able to so capably theorize industrial factories at a time when large-scale industry was still comparatively undeveloped. He argues that the fact that Babbage's theorizations mobilized a "machine ontology" that pre-existed the large scale machines themselves shows that his work and the machine ontology both derive from social relations dominating the early industrial scene and which would only later become embedded in the large-scale

knowledge of factory production Babbage's thinking was already shaped by industrial capitalism's values and priorities, because as an undergraduate in the 1810s Babbage was already endorsing algebra on the basis that it rationalized the mind's productivity and organization. When he later began touring industrial factories in the 1820s, Babbage assumed the factories were enacting the scientific principles that he had already argued were latent in the facts of mathematics—as opposed to the capitalist ideologies which he had read into mathematics. Specifically, because he already saw algebra as modeling a division of labor, Babbage naturalized the social relations he witnessed in factories by describing the industrial division of labor as enacting a principle of mathematics. He concludes, "the arrangements which ought to regulate the interior economy of a manufactory, are founded on principles of deeper root than may have been supposed, and are capable of being usefully employed in preparing the road to some of the sublimest investigations of the human mind" (*Economy* 191). Within the division of mathematical labor that he envisions, while the deskilled and mechanized mass of workers perform the monotonous and therefore "mechanical" aspects of the labor process, the role of the inventor / genius is premised on the fantasy that defined the emerging figure of the professional by the supposedly non-alienated nature of his labor.[30]

This fantasy of non-alienated labor is premised on an ideological division between "human" and "mechanical" labor. As I showed in chapter 1, critics of the Factory System claimed factory labor made inhuman demands and "mechanized" the

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machinery itself. I am similarly arguing that Babbage's thinking was shaped by an awareness of capitalist social relations that was dominant and naturalized despite pre-existing the full development of large-scale industrial factories or Babbage's industrial tourism.

[30] Here I argue contrary to Ashworth, who claims Babbage sought "to industrialize the human mind," whereas I argue he sought to relieve the mind of the mechanical aspects of the labor process, leaving the mind of the genius / inventor free to pursue the increased mental productivity that algebra allowed.

worker by imposing the machine's repetitive, monotonous, and tedious labors onto the body. Apologists agreed these forms of labor were inhuman, but claimed factory labor in fact relieved the worker of the distinctly mechanical aspects of the labor process by consigning those labors to the machines. Babbage reproduces this ideological separation of human and mechanical labor, and as early as his preface to the *Memoirs of the Analytical Society* described math as a labor process that should be divided along lines separating intellectually stimulating from tedious, unrewarding, and therefore "mechanical" labors:

> The ingenious Analyst who has investigated the properties of some curious function, can feel little complaisance in calculating a table of its numerical values; nor is it for the interest of science, that he should *himself* be thus employed, though perfectly familiar with the method of operating on symbols; he may not perform extensive arithmetical operations with equal facility and accuracy; and even should this not be the case, his labours will at all events meet with little remuneration. (viii, original emphasis)

In contrast to the mental stimulation the "ingenious Analyst" enjoys in investigating "some curious function," the task of calculating tables is entirely undesirable because it is boring and tedious. Thus even though Babbage had not yet observed monotonous and repetitive labor in industrial factories, he already felt that any "mechanical" aspects of the labor process should be taken over by machinery. Like the earliest "type-writers," at this time "calculators" were in fact human workers who did the long, monotonous, repetitive labor of calculating tables, a job at which Babbage was briefly employed as an

undergraduate. As he recalls in his autobiography, while laboring away at calculating his tables at Cambridge, Babbage wished that this monotonous portion of his work could be "calculate[d] by steam" (qtd. in Hyman 49). As he later recalled in a letter to Sir Humphrey Davy, "The intolerable labour and fatiguing monotony of a continued repetition of similar arithmetical calculations, first excited the desire, and afterwards suggested the idea, of a machine, which, by the aid of gravity or any other moving power, should become a substitute for one of the lowest operations of human intellect" (212).[31] Babbage thereby hit upon his idea to invent the Difference Engine to take over the mechanical aspects of mathematical labor, relieving humans of this distinctly inhuman labor and ensuring accuracy and precision promised by the ideology of mechanism.[32]

Babbage decided that in order to design his Difference Engine he would first have to learn as much as he could about machinery. He spent the 1820s touring as many industrial factories as possible throughout England and France, and eventually settled on basing the design for his Engine on the Jacquard loom's punch-card technology. These industrial tours became the basis for his most well-known text, *On the Economy of*

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31 Babbage wrote, "One great advantage which we may derive from machinery is from the check which it affords against the inattention, the idleness, or the dishonesty of human agents" (qtd. in Hyman 110).

32 The most recent scholars to interpret Babbage's efforts have focused on arguing that Babbage set out to model his Engine on the human brain. Schaffer's claims that Babbage set out to make machines "intelligent," and he capitalizes on the ways Babbage's language of "intelligence," "memory," and "anticipation" borrows concepts from human brain functions: "In 1838 he confessed that 'in substituting mechanism for the performance of operations hitherto executed by intellectual labour . . . the analogy between these acts and the operations of the mind almost forced upon me the figurative employment of the same terms'" (204-08). This interpretation discounts the central role Babbage ascribed to the Engine's human programmer, which Babbage actually argued in his *Ninth Bridgewater Treatise* offered an explanation for miracles in that God had programmed them at the time of Creation. Laura Otis unpersuasively fits Babbage into her schematic union of bodily and machinic networks, arguing from scanty textual evidence that Babbage had an interest in the human brain and nerves and that he modeled his Engine's organization on the nervous system's structure (32-33).

Machinery and Manufactures (1832).[33] Perhaps the most influential experience Babbage describes in *On the Economy* occurred in France, where he observed Baron de Prony's organization of mathematical laborers along an intelligence-based division of labor inspired by his reading of Adam Smith's *Wealth of Nations*. This was a crucial influence on Babbage's own contributions to political economy, primarily his argument that the division of labor was applicable to mental as well as physical labor. As Babbage describes, de Prony divided his workers into three sections. In the first section, five or six of the "most eminent mathematicians in France" investigated analytical expressions and devised formulae; "This section had little or nothing to do with the actual mathematical work" (194). The second section consisted of "seven or eight persons of considerable acquaintance with mathematics: and their duty was to convert into numbers the formulæ put into their hands by the first section,—an operation of great labour" (194). Next, the third section's sixty to seventy members received the completed formulae and filled in the tables "using nothing more than simple addition and subtraction" (194). Babbage thus saw in de Prony's workers the full-scale enactment of the division of labor produced by algebraical thinking wherein the "eminent mathematicians" were freed from "the actual mathematical work" and "great labour" assigned to the deskilled and devalued second and third sections who had "no knowledge of arithmetic beyond the two first rules which they were this called upon to exercise" (195). The labor of the third class, Babbage remarks, "may almost be termed mechanical, requiring the least knowledge and by far the

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[33] Hyman says Babbage's "visits to industry became celebrated: charming, courteous, very knowledgeable, and remarkably patient, he was an excellent and appreciative observer and guide" (55). Hyman argues that, more than merely a work of economic theory and analysis, Babbage wrote the *Economy* as a basis for action: "By no means satisfied with interpreting industrial phenomena, his object was, by the systematic application of mathematical techniques and scientific method, to change and improve commercial and industrial practice" (105).

greatest exertions," and he looks ahead to the time "when the completion of a calculating-engine shall have produced a substitute for the whole of the third section of computers" (196, 195).[34]

In addition to modeling the role of the inventor in this division of labor, De Prony's method was important to Babbage's theory of invention because the actual process by which he arrived at his innovation itself exemplifies the philosophy of invention based on algebraical principles that Babbage had envisioned decades earlier. With great admiration Babbage compares de Prony to a manufacturer who, "by his own genius," forms the idea for an innovation or improvement in the machinery: "he makes drawings of his plans of the machinery, and may himself be considered as constituting the first section. He next requires the assistance of operative engineers capable of executing the machinery he has designed . . . and these constitute his second section"

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34 Rather than recognizing that the division of labor functions to de-skill the workers of the other classes and de-value their labor, for Babbage the application of the division of labor to mental processes naturalizes the resulting social relations and class divisions because he sees each performing the labor "for which his natural capacity and acquired habits have rendered him most fit" (379). In addition to "possess[ing] much more skill," Babbage notes that the workers who perform the higher mental functions of inventing machinery "are paid much more highly than that class who merely *use it*" (371, original emphasis). This naturalization of class divisions and the value of workers' abilities as natural traits pre-existing the imposition of the divisions of the labor process allowed Babbage in his *Economy* to make his most original contribution to classical political economy, now known as the "Babbage principle": "the effect of the *division of labour*, both in mechanical and in mental operations, is, that it enables us to purchase and apply to each process precisely that quantity of skill and knowledge which is required for it: we avoid employing any part of the time of a man who can get eight or ten shillings a day by his skill in tempering needles, in turning a wheel, which can be done for sixpence a day; and we equally avoid the loss arising from the employment of an accomplished mathematician in performing the lowest processes of arithmetic" (201, original emphasis). Braverman's analysis of the Babbage Principle: "In the mythology of capitalism, the Babbage principle is presented as an effort to 'preserve scarce skills' by putting qualified workers to tasks which 'only they can perform,' and not wasting social resources.' It is presented as a response to 'shortages' of skilled workers or technically trained people, whose time is best used 'efficiently' for the advantage of 'society.' . . . The capitalist mode of production systematically destroys all-around skills where they exist, and brings into being skills and occupations that correspond to its needs. Technical capacities are henceforth distributed on a strict 'need to know' basis. . . . In this way, a structure is given to all labor processes that at its extremes polarizes those whose time is infinitely valuable and those whose time is worth almost nothing. This might even be called the general law of the capitalist division of labor" (81-83).

(195-96). (The third section consists of factory workers who merely use the new and improved machinery.) His comparison between the labor of a manufacturer inventing new machinery and a mathematician devising new algebraic formulae is far more than just a convenient analogy. In both scenes of invention algebra is used to transform a complex real-world problem into an abstraction. As Babbage argued in his advocacy for the higher math, algebra allows one to mentally apprehend a problem in its entirety by translating it into symbolic language and condensing it into algebraic formulae.[35]

Algebra's ability to transform the whole complexity of mechanical invention into abstractions that can be fully grasped by the individual mind is made clear by Babbage's associate Dionysus Lardner, who wrote an article about the Difference Engine for the *Edinburgh Review* in 1832. Amid Babbage's well-known disputes with Parliament over the Engine's funding, Lardner's goal was to explain to the public the social utility of the mechanical notation which was the product of its mathematical labor. As he explains,

> the mechanical notation [of Babbage's Difference Engine] derives a great portion of its power as an instrument of investigation and discovery [because] it enables the inventor to dismiss from his thoughts, and to disencumber his imagination of the arrangement and connexion of the mechanism. . . . When once the peculiar conditions of the question are translated into algebraical signs, and "reduced to an equation," the computist dismisses from his thoughts all the circumstances of the question, and is relieved from the consideration of the complicated

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[35] In his reading of *The Economy*, Bizup similarly finds that its "underlying premise is that machines and factories are best understood not as concrete entities but as abstract and mathematically describable systems" (59).

> relations of the quantities of various kinds which may have entered it. He deals with the algebraical symbols, which are the representatives of those quantities and relations . . . and, by a process almost mechanical, he arrives at the required result. The various parts of the machinery under consideration being once expressed upon paper by proper symbols, the enquirer dismisses altogether from his thought the mechanism itself, and attends only to the symbols. (316)

Lardner goes on to give an example, drawing on Babbage's personal experience inventing the Difference Engine. Though he omits their names, Lardner's anecdote about an inventor who was "assisted by a practical engineer of considerable experience and skill" would have quickly recalled to his readers the infamous relationship between Babbage and his engineer Joseph Clement who was charged with building the Engine based on Babbage's design (316). As Lardner tells the story, while the two were working on the Difference Engine,

> A question arose as to the best method of producing and arranging a certain series of motions necessary to print and calculate a number. . . . To accomplish this, the engineer sat down to study the complicated details of a part of the machinery which had been put together; the inventor at the same time applied himself to the consideration of the arrangement and connexion [*sic*] of the symbols in his scheme of notation. . . . Here the powers of the practical engineer completely broke down. By no effort could he bring before his mind such a view of the complicated mechanism as would enable him to decide upon any improved arrangement. (316)

The inventor (i.e. Babbage), however, "without any extraordinary mental exertion," was able to quickly locate the problem and propose a solution simply by examining his plans and by using the "symbolic instrument with which he conducted the investigation" (316). The inventor and the engineer are engaged in the same project: they encounter the same problems and questions and are both engaged in highly skilled and innovative labor. The difference between them is that while the engineer works in the realm of the concrete in constructing the physical invention, the inventor translates all of this into the realm of abstraction. For Babbage, algebra accelerates the work of invention by producing a division of labor founded on the opposition between the abstract and the concrete, and it is this difference that separates the labor of the inventor from every other class of labor beneath him, from the highly skilled mental labor of his head engineer down to the mechanized factory workers laboring under the invention as a finished product.

While Babbage's algebraical division of labor is founded on the abstract and concrete as separate realms of labor, he also theorizes another, contradictory foundation for the division of labor as a direct result of conflicts with Clement, who was charged with transforming Babbage's abstract plans into a concrete reality. Scholars have pointed out that as a direct result of this conflict over ownership, Babbage made special effort in his *Economy* to differentiate the role of the *manufacturer* (the inventor) from the *maker* (the engineer). As Bizup explains, Babbage's goal was to prioritize the mental labor of innovation from the solely manual labor of production: "The conflict between Clement and Babbage thus touches on the more general question of whether ownership in an industrial society derives (as Clement held) from production and use or (as Babbage

maintained) from initial conception and design" (60-61).[36] Braverman goes further, crediting Babbage as the first to separate *conception* from *execution*. He argues that while this initially characterized the separation of mental and manual labor, beginning with Babbage the separation of conception from execution came to structure all mental labors as well, and has now come to pervade every form of labor in capitalist society (316-18).[37]

However, Bizup and Braverman fail to recognize that in Babbage's re-theorization of the division of labor as between manufacturers and makers, the categories of mental and manual labor that he employs are purely ideological constructions. Lardner's anecdote shows Clement's labor to be just as investigative, innovative, and intellectual as the inventor's, but Babbage aims to categorize invention / conception as purely mental labor, and execution / production as entirely manual in order to gain advantage in his struggles with Clement over ownership and intellectual property. While throughout Babbage's writings he argues that invention and scientific innovation are motored by a dialectical interaction between abstract and concrete labor, he also aims to naturalize property rights and exploitative social relations by dividing mental from

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36 In a letter written to Babbage, Clement's draughtsman, Jarvis, explained the issue as a matter of conflicting economic interests: "it should be borne in mind that the inventor of a machine and the *maker* of it have two distinct ends to obtain. The object of the first is to make the machine as complete as possible. The object of the second—and we have no right to expect he will be influenced by any other feeling—is to gain as much as possible by making the machine; and it is in his interest to make it as complicated as possible" (qtd. in Hyman 127). Babbage must have had a good working relationship with Jarvis since they continued to work together on designing the Analytical Engine.

37 Braverman explains, "Mental labor is carried on in the brain, but since it takes form in an external product—symbols in linguistic, numeric, or other representational forms—it involves manual operations such as writing, drawing, operating writing machines, etc.—for the purpose of bringing this product into being. It is therefore possible to separate the functions of conception and execution: all that is required is that the scale of the work be large enough to make the subdivision economical for the corporation. Among the first to recognize this was Charles Babbage. . . . The progressive elimination of thought from the work of the office worker thus takes the form, at first, of reducing mental labor to a repetitious performance of the same small set of functions. The work is still performed in the brain, but the brain is used as the equivalent of the hand of the detail worker in production, grasping and releasing a single piece of 'data' over and over again" (316-19).

manual labor, constructed as discrete and mutually exclusive modes of work.[38] He collapses his dialectic between abstract and concrete labor into the ideological opposition between mental and manual labor in an effort to align his inventor with the emerging figure of the professional. Amidst claims for copyright and patent protections, writers and inventors alike were engaged in establishing the mental labor of the professional as non-alienated, self-directed, and therefore productive of intellectual property. Central to this endeavor was the construction of their mental labor as non-alienated through its opposition to the mechanized factory laborer, as well as the categorization of the products of their labor—books and machines—as containing unique intellectual property through their opposition to the infinitely reproducible material products of industrial machines. While Babbage attempts to neatly separate the mental labor of innovation from the manual labor of production, the fact remains that all labors—from the unique genius to the mechanized factory worker—contain both mental and manual elements and that material production and mental production are both potentially innovative and potentially subject to mechanization. The ideological stakes of these categories of mental and manual labor—in the early nineteenth century and now—are that they mark certain forms of labor and certain products of labor as innovative, creative, and productive of intellectual property, while devaluing all other forms of labors as productive of only material products. The figure of the professional and the debates about mental labor thus

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[38] Babbage theorizes the realms of the abstract and the concrete as comprising a dialectic. As new technologies emerge to take over more aspects of the labor process, the mind is able to do more, the genius to reach farther, and what was once out of reach now becomes common knowledge. The tasks undertaken by inventors thus draw an ever-shifting line motored by technological development. In *Reflections on the Decline of Science in England* Babbage explains, "In mathematical science, more than in all others, it happens that truths which are at one period the most abstract, and apparently the most remote from all useful application, become in the next age the bases of profound physical inquiries, and in the succeeding one, perhaps, by proper simplification and reduction to tables, furnish their ready and daily aid to the artist and the sailor" (17-18).

served to secure property rights for certain laborers by denying them to others.

Part 4: *Little Dorrit*: Math, Mechanization, and the Division of Labor

While Babbage thought the algebraical division of labor could accelerate the progress of science by separating abstract from concrete labors, Dickens critiques this division as the most dangerous problem with speculative finance. In this final section, I return to *Little Dorrit* to examine its critique of the mechanizing effects of mathematical and financial labor. It is well known that Dickens originally intended to title the novel "Nobody's Fault" and for his frustrations with the failure of personal responsibility in Victorian society to figure more prominently in its plot.[39] While Doyce is not one of the novel's main characters, he is extremely important to the novel's central concern with the gulf between an economic self-interest that leads to the utter evasion of personal responsibility, and Doyce's lack of self-interest and desire to work for the works' sake. The novel's idealized representation of Doyce's professional labor as selfless and thus unalienated is usually read in relation to Amy Dorrit's domestic labors, which are so selfless that they result in her complete vanishing of self.[40] I want to shift the direction of this conversation to foreground the opposition between the supposedly unalienated labor

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[39] Variations on the word "nobody" reverberate throughout the text. His frustration with a pervasive lack of responsibility—epitomized in the government's mismanagement of the Crimean War—found one outlet in an article for *Household Words* published during the middle of *Little Dorrit*'s serialization called "Nobody, Somebody, and Everybody" (30 Aug. 1856). Dickens writes, "The power of Nobody is becoming so enormous in England, and he alone is responsible for so many proceedings, both in the way of commission and omission; he has so much to answer for, and is so constantly called to account. . . . The hand which this surprising person had in the late war is amazing to consider. . . . Nobody has done more harm in this single generation than Everybody can mend in ten generations. Come, responsible Somebody; accountable Blockhead, come!" (482; 485).

[40] Critics often follow Poovey in examining the mental labor of the professional in relation to domestic labor. Pettit claims that while Doyce's labor is unalienated, Amy Dorrit's is "emphatically alienated": "Work seems to threaten the basis of identity, unless it can be represented, as is Doyce's invention, as unalienated" (196-97).

of the professional and the mechanization of the other mental and manual laborers beneath him in a hierarchical division of labor, modeled on Babbage's theorization. The novel establishes Doyce's labor as unalienated precisely through its opposition to the mechanization of the financial and mathematical laborers beneath him; however, despite this idealization, the novel's structural use of Doyce as its *deus ex machina* reveals the deep tensions in Dickens's thinking about his own professional labor as inescapably grounded in the economic self-interest of a market society.

Doyce is positioned at the top of the hierarchical division of labor: he is the inventor and delegates to everyone beneath him the tedious, undesirable aspects of the labor process. This hierarchy forms the chain of management of Bleeding Heart Yard and is imaged in its architecture, which places Clennam's office in the attic above the mechanical operations of the factory workers. Whereas these laborers—particularly Clennam and Pancks—are represented as mechanized by their mathematical and financial labors, Doyce's work is entirely self-directed by his innate genius, absolutely selfless in being unmotivated by financial gains or social status. When he describes his inventions to Clennam, for example, he emphasizes the invention's usefulness, rather than his own ingenuity: "He never said, I discovered this adaptation or invented that combination; but showed the whole thing as if the Divine artificer had made it, and he had happened to find it" (496; bk 2; ch 8).[41] Critics have often remarked that with this passage, Dickens distances Doyce from messy issues of property, commercial value, and self-interest in

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[41] Doyce's focus on his invention's usefulness is an idealized version of the professional fiction writers' efforts to establish their lack of self-interest: "In claiming professional status, the members of the Guild of Literature and Art, most prominently Dickens, Bulwer Lytton, and Forster all placed a strong emphasis on the *instrumentality* of literature, claiming that literary interventions in public life could have a direct, practical effect" (Pettit 157, original emphasis).

order to show that he works for the works' sake.[42] In addition to denying Doyce's embroilment in economic self-interest, the passage also erases the labor of everyone else in Bleeding Heart Yard upon which his escape from alienation depends. Doyce's freedom as well as his genius—both its practical daily operations and his professional status—depend on their separation from the labor that dramatically mechanizes other characters, like Clennam and Pancks, to whom the most mechanical labors are delegated. For Dickens, these "mechanical" labors include not only the most unrewarding, repetitive, and tedious aspects of the labor process, but specifically and primarily the mental labor of math.

Whereas Pettit attributes Doyce's position in the division of labor to the novel's concern to separation "property and labor," I see the partnerships of divided labor in the novel as a revision of Babbage's separation of abstract and concrete labor (191). The division of labor between Pancks and Casby is often described as the separation of the Works from the Winder—the difference between a machine and its operator—and in other places as the separation of the Proprietor and his Grubber—a class-based distinction between management and labor. This division of labor transforms Pancks, the novel's most overtly mechanized character, into an engine: "a little coaly steam-tug will bear down upon it, take it in tow, and bustle off with it; similarly the cumbrous Patriarch had been taken in tow by the snorting Pancks, and was now following in the wake of that dingy little craft" (151-52; bk 1; ch 13). As a result, his entire body is composed of

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[42] Doyce's way of doing business is tellingly counterpointed in the novel by the Merdle business, which is shown in the end to be an empty shell of self-interest, greed, and pursuit of value. Markles says Dickens deliberately "focus[es] the idealization of Doyce on use-value labor before it is alienated into surplus" (42). Jarvie points out that Doyce's partnership with Clennam is an additional way Dickens separates Doyce from the actual business of the firm and the fact that his factory makes things in order sell them for profits (112).

mechanical elements, like a steam engine made filthy by constant use: "He was dressed in black and rusty iron grey; had jet black beads of eyes; a scrubby little black chin; wiry black hair striking out from his head in prongs, like forks or hair-pins. . . . He had dirty hands and dirty broken nails, and looked as if he had been in the coals; he was in a perspiration, and snorted and sniffed and puffed and blew, like a little labouring steam-engine" (150-51; bk 1; ch 13).[43] Further down the hierarchy, Meagles is reduced to mere tools: his "arithmetical solidity belonging to the scales and scoop" are emblematic of his fixation on his financial labors of measuring and doling out (199; bk 1; ch 16). In *Little Dorrit*, where we see almost nothing of the Bleeding Heart Yard factory workers, it is primarily the mental labors involved in financial work which mechanize characters.

Doyce and Clennam's partnership is premised on a division of mental labor between Doyce's inventive genius and the mechanized, routine monotony of bookkeeping in which Clennam immerses himself. Pancks describes Clennam's job as "not a partner in his mechanical knowledge, but in the ways and means of turning the business arising from it to the best account . . . a question of figures and accounts" (199; bk 1; ch 16). Clennam throws himself wholeheartedly into "mechanically discharging" his duties, including the tedious, senseless pursuit of the Circumlocution Office: "and so the work of form-filling, corresponding, minuting, memorandum-making, signing, counter-signing, counter-counter-signing, referring backwards and forwards, and referring sideways, crosswise, and zig-zag, recommenced" (270; bk 1; ch 23, 497; bk 2;

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[43] Later in the novel Pancks is electrically powered: "His little black eyes sparkled electrically. His very hair seemed to sparkle as he roughened it. He was in that highly-charged state that one might have expected to draw sparks and snaps from him by presenting a knuckle to any part of his figure. . . . Where he got all the additional black prongs from, that now flew up all over his head like the myriads of points that break out in the large change of a great firework, was a wonderful mystery" (373-75; bk 1; ch 32).

ch 8). The list structure of this sentence and the rigidity of its elements force onto the reader the boredom, monotony, and tediousness of Clennam's labors. When Clennam finishes updating and organizing their accounts, Doyce examines them "as if they were a far more ingenious piece of mechanism than he had ever constructed, and afterwards stood looking at them, weighing his hat over his head by the brims, as if he were absorbed in the contemplation of some wonderful engine" (644; bk 2; ch 22). And it is at this point that he cautions Clennam against speculating: "If I have a prejudice connected with money and money figures,' continued Doyce, laying that plastic workman's thumb of his on the lapel of his partner's coat, 'it is against speculating. I don't think I have any other. I dare say I entertain that prejudice, only because I have never given my mind fully to the subject'" (644; bk 2; ch 22).

But Pancks the steam engine *has* given his mind fully to the subject. He assures Clennam that the Merdle speculation is safe and strongly encourages him to invest: "Be as rich as you honestly can. It's your duty. Not for your sake, but for the sake of others. . . . Poor Mr Doyce (who really is growing old) depends upon you. Your relative depends upon you. You don't know what depends upon you" (561; bk. 2; ch 13). In addition Clennam's own self-interest, Pancks argues he has a responsibility to get rich for the benefit of his family, society, but particularly for Doyce, who lacks financial motivation and self-interest: "Manage it better . . . Recompense him for his toils and disappointments. Give him the chances of the time. He'll never benefit himself in that way, patient and preoccupied workman. He looks to you, sir" (559; bk 2; ch 13). This final phrase—"He looks to you, sir"—implies that rather than being entirely without self-interest, Doyce has in fact delegated the labor of money-making to Clennam.

When Pancks infects Clennam with speculation fever, he begins by seeming to criticize the other investors who joined in the Merdle speculation without first checking the math:

> "[Y]ou see these people don't understand the subject. . . . Know nothing of figures. Know nothing of money questions. Never made a calculation. Never worked it, sir!" . . .
>
> "If they had," observed Clennam, who was a little at a loss how to take his friend, "why, I suppose they would have known better."
>
> "How so, Mr Clennam?" Pancks asked quickly, and with an odd effect of having been from the commencement of the conversation loaded with the heavy charge he now fired off. "They're right, you know. They don't mean to be, but they're right. . . . I've gone into it. I've made the calculations. I've worked it. They're safe and genuine." (558-9; bk 2; ch 13)

Clennam and Pancks both assume that any trouble with the Merdle speculation—any dishonesty, any deception—would be revealed by the calculations. What these calculations could not predict, however, is that eventually Merdle kills himself, exposing the deception and causing a run on the bank, and all of their money is lost. Pancks is driven almost insane by the inexplicable fact that the scheme went bad despite his "incontrovertible figures" (731; bk 2; ch 30).

> "I can prove by figures" added Mr Pancks, with an anxious countenance, "that it ought to have been a good investment. I have gone over it since it failed, every day of my life, and it comes out—regarded as a question of

> figures—triumphant. The present is not a time or place," Mr Pancks pursued, with a longing glance into his hat, where he kept his calculations, "for entering upon the figures; but the figures are not to be disputed. Mr Clennam ought to have been at this moment in his carriage and pair, and I ought to have been worth from three to five thousand pounds." (730-31; bk 2; ch 30)

Pancks hits upon the exact problem: while his math is correct, he has only regarded the issue "as a question of figures," with no attention to the concrete reality behind those figures. As Babbage explained, algebra condenses the entirety of a real-world problem by translating it into an abbreviated symbolic language. Dickens, however, felt it was highly problematic to approach an issue entirely in the abstract. As he expressed in the letter quoted in my introduction, for Dickens math and political economy both dangerously remove the full complexity of a real-world problem from one's view, allowing cold, unfeeling, government bureaucracy to reduce its poor and starving people to faceless, abstract "populations."

This is the primary critique which Dickens launches in *Little Dorrit* against financial speculation: it exists entirely in the abstract, and is thus potentially disconnected from the realm of hard work and production of actual value. It offers the tempting promise of money begotten of money, but also the very real danger that one's investment could disappear in a puff of smoke. In the case of the Merdle speculation, his death reveals that there was no real-world enterprise backing up the investments, and he had embezzled everyone's money. Pancks, the "unhappy arithmetician," remains confused by the inexplicable fact that material reality fails to correspond with his abstract figures.

Perpetually flummoxed, he keeps seeking consolation in his "infallible figures which proved that Arthur, instead of pining in imprisonment, ought to be promenading in a carriage and pair, and that Mr Pancks, instead of being restricted to his clerkly wages, ought to have from three to five thousand pounds of his own at his immediate disposal" (759; bk 2; ch 32).

While Pancks assures us repeatedly that his calculations are correct, at the end of the novel—in what is arguably the single most frustrating passage for *Little Dorrit*'s readers—Doyce suddenly returns to announce that he has found a mistake in the math: "There was an error in your calculations. I know what that is. It affects the whole machine, and failure is the consequence. You will profit by the failure, and will avoid it another time. I have done a similar thing myself, in construction, often" (784; bk 2; ch 34). Doyce, who has been absent from England for months (and from the novel for a dozen chapters), suddenly reappears to free Clennam from debtor's prison and undo the financial damage to their business. Though he begins by saying that there was an error in their calculations, in fact it is Doyce's own money, earned through his work as an engineer for Russia, that actually solves Clennam's financial troubles. While most readers express irritation at Doyce's odd remarks and Dickens's lame solution to the novel's need for a happy ending, critics fail to take Doyce's reference to math seriously, or at least to read it as anything more than a metaphorical platitude.[44] Given the novel's

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[44] Amanda Anderson is particularly angry about Doyce's remarks: "Perhaps Doyce is just being nice, but this is a blatantly false analogy in several respects. Drawn in by the speculative tendencies of his age, duped by the forces of global capitalism and the idea that all can share in his profits, Clennam's was no simple mechanical misjudgment. It was the result of pervasive and systematic forces that simply cannot be 'avoided in the future.' An ideal of purposive labor held within the bounds of situated judgment is not sufficient to take on the unavoidable conditions of modern social and economic reality" (89). In identifying an "analogy" in Doyce's words, Anderson follows Larson's similarly irritated evaluation of the passage: "In Doyce's neatly molded reconciliation speech in II.34, he needlessly, almost perversely teaches

larger obsessions with the mechanizing effects of mathematical and financial labor, Doyce's description of his plot resolution as a mechanical solution to a mathematical problem seems a far more deliberate and complex matter than critics have accounted for.

The "error" Doyce discovers in the calculations is not a mathematical error, but the error Pancks and Clennam committed in viewing the world entirely through mathematical abstraction, which dangerously obscured the fact that there was nothing behind Pancks's calculations or the Merdle speculation in the first place. The relation Doyce describes between Clennam's abstract calculations and the construction of a material machine based on these calculations, quickly draws to mind Babbage's similar descriptions of the division of labor between the abstract mathematical work of the inventor and the concrete productions of the engineer Clement. In Babbage's case, both sides to this division of labor need each the other: problems in the machine can be solved by recourse to the plans, and omissions in the plans can be exposed by the process of building the machine. Doyce's language recalls this exact kind of relation between abstract labor and the material invention: "I have done a similar thing myself, in construction, often." Unlike Pancks's calculations, which exist entirely in the realm of the abstract, it is vital that the inventor's labor always occur in relation to the concrete production of his engineer. Despite Babbage's efforts to claim his own labor as exclusively productive of intellectual property rights, the inventor and the engineer (in both Babbage's and Doyce's scenarios) need each other and must engage in both mental

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Clennam to learn from failure; he compares Arthur's disastrous investment to a mechanic's faulty calculations, as though the mind were a machine; and, although he is admirably forgiving, this deus ex machina 'perfectly arranges' things so that Arthur can dismiss the past" (164). Anderson and Larson both assume that Doyce's reference to "calculations" is a translation of the financial endeavor into a mechanical one, and with this assumption both take Doyce's language to be metaphorical, and seem to miss the connection to the actual mathematical calculating with which Pancks is obsessed. My intention is to take Doyce at his word and give the passage a bit more credit.

and manual labors to perfect the invention.

But this explanation of the calculations does not resolve the critics' other complaint. Doyce's return usually receives harsh criticism as an all-too-convenient *deus ex machina*, and most readers are unsatisfied when Dickens "lower[s] Doyce from the rafters with enough money" to offer a far too easy conclusion to the novel's rich complexity (Jarvie 109). I'd like to address this by considering the double meanings of words like "contrivance," "device," and "mechanism" as both plot and actual material tools. While Doyce is arguably the most idealized character in the novel, he is given this task of unsatisfactorily tying up the plot primarily because he functions in the novel as a stand-in for Dickens himself.[45] In this role, Doyce unites the two camps engaged in campaigning for recognition of the social value of the professional—inventors and fiction writers. As professionals themselves, both Babbage and Dickens were personally invested in establishing the social value of their mental labor as exclusively productive of unique intellectual property. However, the economic value of Dickens's novels depended specifically on their combination of both the unique products of literary genius, and their

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[45] Huston calls him "Dickens's alter ego" (80). Pettit argues that the connection between Doyce and Dickens is indicative of "Dickens's own troubled self-perception as an artist" (193). Jarvie similarly concludes that "Doyce doubles Dickens in this creative role, his ability to 'combine what was original and daring in conception with what was patient and minute in execution,' and throws the weight of Dickens's own role as a generative artist, and successful middle-class entrepreneur, who lives, like Doyce, by the products of his personal labor, behind the case for use-value in the novel" (105-06). Others claim Henry Gowan is Dickens's stand-in, even though he is clearly the most despicable character in the novel: "To be in the halting state of Mr Henry Gowan; to have left one of two powers in disgust; to want the necessary qualifications for finding promotion with another, and to be loitering moodily about on neutral ground, cursing both; is to be in a situation unwholesome for the mind, which time is not likely to improve. The worst class of sum worked in the every-day world is cyphered by the diseased arithmeticians who are always in the rule of Subtraction as to the merits and successes of others, and never in Addition as to their own" (468; bk 2; ch 7). These cryptic remarks about math recall Babbage's and Doyce's practice of making obscure comments which no one else was smart enough to appreciate, but unlike theirs, there is no humor in this assessment of Gowan.

reproduction of familiar plot elements.[46] These mechanical plot devices thus exist in tension with Dickens's vision of himself and other professionals as producing unique intellectual property through their unalienated innate genius—attributed by Doyce to the gifts of "the Divine artificer."[47] The fact that the novel uses Doyce as its *deus ex machina* and uses the money he made from his inventions to provide a happy ending for his friends (and for Dickens's readers) foregrounds the text's acknowledgement that even this most idealized, selfless character can never be entirely free from the economics of capitalist production. This tension is thus symptomatic of the larger fact that Victorian cultural debates about the figure of the professional, the construction of his mental labor as socially valuable, and the legislative affirmation of his exclusive rights to intellectual property, are all achieved through establishing and maintaining a delicate and purely ideological opposition between the fantasy of his unalienated mental labor, and the mindlessness and mechanization of the factory worker.

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[46] Peter Garret's examination of Dickens's multiplot novels takes seriously the mechanical nature of certain elements of their plotting, and compares *Little Dorrit*'s plot machinery to Doyce's factory's "straps and wheels; which, when they were in gear with the steam engine, went tearing round as though they had a suicidal mission to grind the business to dust and tear the factory to pieces" (261).

[47] See Huston's comments on letters written by Dickens during the composition of *Little Dorrit* in which he complains about his difficulty keeping up production of the novel on the exhausting schedule demanded by serialization (78-79). See Poovey on the "factory-like" conditions of Victorian literary production (104-05).

Conclusion

Technophobia / Technophilia

During the factory tour scene in Benjamin Disraeli's industrial novel *Coningsby* (1844), the narrator employs standard, pro-industry rhetoric in describing the machinery as a "slave" to the worker in order to imply that it alleviates human toil (150). But this predictable assessment is quickly qualified: the machinery is next called a "supernatural slave" and then described as "mysterious forms full of existence without life" (150). When he enters the factory, Coningsby's immediate reaction is one of trepidation: "it is the machinery without any interposition of manual power that overwhelms me. It haunts my dreams" (150). In his anxious imagination, he continues, "I see cities peopled with machines. . . . And yet the mystery of mysteries is to view machines making machines; a spectacle that fills the mind with curious, and even awful, speculation" (150, 152). As seen in this scene from *Coningsby*, the technological determinist argument that all advancements in technology are categorical improvements in alleviating human toil by replicating and replacing human labor often carried with it latent fears of the dystopian possibilities suggested by this increasingly self-directed and life-like machinery.

It has been the primary argument of this dissertation that the categories of human labor and machine labor were constructed in the early nineteenth century as categorically oppositional and thus provided the ideological foundation for a dichotomy that continues to structure our thinking about the relation between our bodies and the technologies that increasingly pervade our everyday lives. These perspectives are generally polarized into technophobic fears of machines controlling, dehumanizing, or replacing the laboring

body, and technological determinist celebrations of new technologies as categorical improvements to human life, offering the tempting promise of maximizing human efficiency. In this dichotomy I locate the emergence of the particular forms of this technophilia and technophobia which persist in our culture to this day. Twentieth-first-century advertisements regularly use images of the body achieving maximized efficiency through mechanization in order to sell products like Android phones, in which the image of a body turning into a machine signals progress, the conquering of human limitations, and the technological determinist promise of all technologies as categorical improvements to human life and signs of progress and humanity's increasing control over and domination of nature. These images are countered by the oft-repeated cautionary tale that machinery will advance and increasingly replace human tasks by becoming more and more life-like until, like Sky-Net in the *Terminator* films and the Cylons in the *Battlestar Galactica* TV series, it becomes "self-aware" and turns against humanity, fueled by the desire to completely dominate and extinguish the human race. This pair of alternately utopian and dystopian potential futures—the body achieving mechanical perfection and the machine achieving human consciousness—emerged, I argue, directly from the early-nineteenth-century industrial moment in which the newly mechanized labor process was endorsed by those celebrating the new "self-acting" machinery and critiqued by those fearing the outcome of workers being increasingly dominated by the imposition of mechanical characteristics onto the human body.

This crux of Victorian technological debates also generically structured the two possible futures that could be imagined by science fiction and utopian literature, which significantly increased in production in the second half of the nineteenth century. The

dichotomy receives its most direct articulation in the dystopian possibilities imagined in Samuel Butler's *Erewhon* (1872).[1] In the utopian tradition, *Erewhon*'s narrator, Higgs, discovers an unknown land, and each chapter of the book describes some aspect of the new society. When Higgs first arrives in Erewhon, the Erewhonians immediately notice he is wearing a wristwatch, and they totally freak out. When lecturing him on his violation proves pointless, they try to overcome the language barrier by bringing him to a museum.

> There were fragments of steam engines, all broken and rusted; among them I saw a cylinder and piston, a broken fly-wheel, and part of a crank, which was laid on the ground by their side. Again, there was a very old carriage whose wheels in spite of rust and decay, I could see, had been designed originally for iron rails. Indeed, there were fragments of a great many of our own most advanced inventions; but they seemed all to be several hundred years old, and to be placed where they were, not for instruction, but curiosity. As I said before, they were all marred and broken. (82-83)

The steam engine and railroad were the primary symbols of British industrial progress, and the disorienting and confusing sight of their broken and ancient remnants stored as

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[1] Sue Zemka echoes the general critical assessment when she states that, in the novel's "Book of the Machines" chapters, *Erewhon* "originates the conceit by which machines develop intelligent capacities and enslave mankind" (462). While *Erewhon* has certainly been an influential text for later science fiction writers, granting the novel this originary status problematically shuts down readings of the text that position its ideas as an extension of an actually broad set of cultural contexts, particularly the rhetoric and imagery of industrial literature, as well as a part of a group of literary texts similarly concerned with bodies and machines that emerged in the 1870s. The novel's discussion of bodies and machines is echoed in the chapter "Shadows of the Coming Race" in George Eliot's *Impressions of Theophrastus Such* (1879). The opposite, technophilia prognosis for a utopian future is depicted in Edward Bulwer-Lytton's *The Coming Race* (1871) in which humans have evolved to biologically control a form of electricity which they use to motor wings that they strap to their bodies as well as the automata that do all their domestic labor.

mere curiosities would have immediately alerted Butler's Victorian readers that Higgs had strayed into a world that was entirely unlike, and perhaps the complete inversion, of their own. In later chapters Higgs learns that these mechanical relics are the casualties of a civil war which had divided Erewhon into machinist and anti-machinist factions and "which had ended in the destruction of so many of the mechanical inventions which were formerly in common use" (195). This "revolution" was brought on by the publication of a political tract which Higgs translates and reproduces in the novel's three "Book of the Machines" chapters.[2] The writer of this tract warns "against the ultimate development of mechanical consciousness," and he argues that "we should destroy as many of them [machines] as we can possibly dispense with, lest they should tyrannise over us even more completely" (199, 207). The writer explains,

> I fear none of the existing machines; what I fear is the extraordinary rapidity with which they are becoming something very different to what they are at present. No class of beings have in any time past made so rapid a movement forward. Should not that movement be jealously watched, and checked while we can still check it? And is it not necessary for this end to destroy the more advanced of the machines which are in use at present, though it is admitted that they are in themselves harmless? (203)

Butler develops this writer's fears of mechanical evolution by drawing heavily on Darwin's theories of evolution. As odd and unique as this logic may perhaps seem, viewing machinery as comprising a "Kingdom" parallel to the Animal Kingdom was not

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[2] The three "Book of the Machines" chapters are formed of revised and rewritten material from Butler's earlier articles "Darwin among the Machines" (1863), "Lucubratio Ebria" (1865), and "The Mechanical Creation" (1865), which inserted into the novel as ancient Erewhonian texts translated by the narrator Higgs.

a major innovation, but only an extension of the rhetoric used in numerous discussions of industrial technology beginning in the 1830s, which regularly described machinery as a species organized in taxonomical terms. In elaborating his argument, Butler in fact draws heavily upon discussions about mechanization and industrialization with which Victorian readers were likely to have been quite familiar. His fear that machines may soon "tyrannise over us even more completely," for example, gains its primary support from descriptions of factory workers dominated by machinery in a mechanized industrial labor process:

> How many men at this hour are living in a state of bondage to the machines? How many spend their whole lives, from the cradle to the grave, in tending them by night and day? Is it not plain that the machines are gaining ground upon us, when we reflect on the increasing number of those who are bound down to them as slaves, and of those who devote their whole souls to the advancement of the mechanical kingdom? . . . What an army of servants do the machines thus employ! Are there not probably more men engaged in tending machinery than in tending men? Do not machines eat as it were by mannery? Are we not ourselves creating our successors in the supremacy of the earth? daily adding to the beauty and delicacy of their organisation, daily giving them greater skill and supplying more and more of that self-regulating self-acting power which will be better than intellect? (208-09)

This rhetoric could easily be drawn from critiques of factory labor like those discussed in this dissertation's first chapter. Butler's writer draws upon common beliefs that factory

workers were “in bondage to the machine” and “bound down to them as slaves” due to the inescapable demands of “tending machinery.” By combining this with the common celebration of machinery as “self-acting,” Butler’s writer is able to argue for a direct link between the fact that machinery as becoming more life-like and its increasing domination of the factory worker to produce a Darwinian prediction about the future evolution and “advancement of the mechanical kingdom.”

In *Erewhon*, the possibility of mechanical evolution leading to the world domination of machines gains its success as satire in that it so accurately reproduces the logic that it is lampooning—the ideology of mechanism taken to its logical extreme. This is foregrounded in an indirect reference made by Butler’s writer to Babbage’s Difference Engine:

> And take man’s vaunted power of calculation. Have we not engines which can do all manner of sums more quickly and correctly than we can? . . . In fact, wherever precision is required man flies to the machine at once, as far preferable to himself. Our sum-engines never drop a figure, nor our looms a stitch; the machine is brisk and active, when the man is weary; it is clear-headed and collected, when the man is stupid and dull; it needs no slumber, when man must sleep or drop; ever at its post, ever ready for work, its alacrity never flags, its patience never gives in; its might is stronger than combined hundreds, and swifter than the flight of birds; it can burrow beneath the earth, and walk upon the largest rivers and sink not. (205)

Drawing here upon the ideological assumption that machinery is categorically precise,

tireless, and "ever ready," as well as the construction of human labor in categorical opposition to this exhaustless machine, Butler's writer extrapolates from this celebration of the superiority of machines a dystopian scene of the machine not only surpassing man's natural capacity for mental and manual labor, but inevitably dominating the natural landscape and humanity with it.

After quoting at length from this particular tract, Butler's narrator turns to discuss a second text which was written to refute the "anti-machinist" argument.

> Its author said that machines were to be regarded as a part of man's own physical nature, being really nothing but extra-corporeal limbs. Man, he said, was a machinate mammal. The lower animals keep all their limbs at home in their own bodies, but many of man's are loose, and lie about detached, now here and now there, in various parts of the world—some being kept always handy for contingent use, and others being occasionally hundreds of miles away. A machine is merely a supplementary limb; this is the be all and end all of machinery. We do not use our own limbs other than as machines; and a leg is only a much better wooden leg than anyone can manufacture. (223)

While the anti-machinist argument extrapolates from the categorical opposition between human and mechanical labor a technophobic fear of machines increasingly dominating man, this counter-argument offered by the machinist side in the Erewhonian debate expresses the technological determinist position that all innovations are categorical advances through which man comes to increasingly dominate nature. As this writer concludes, "Thus civilization and mechanical progress advanced hand in hand, each

developing and being developed by the other" (223).

More than simply the originator of a dystopian fear of machines dominating humanity, Butler's *Erewhon* neatly and succinctly summarizes (so as to lampoon) the dichotomous views of machinery which emerged out of the Victorian debates about industrialization and which continue to persist in both our cultural imagination of science fiction futures, and in our understanding of our relation to the technologies of our everyday lives. As this dissertation has argued throughout, both sides to this dichotomy—both versions of the body-machine relation, both visions of technological progress—constitute not only a false binary, but also function as mystifications of the social relations embedded in the technologies of the labor process.

I think the most profitable way of understanding the "Book of the Machines" chapters in Butler's *Erewhon* is as critiquing a binary of received ideas. In so doing, these chapters continue what has been Butler's purpose throughout the novel, which is to present the dominant ideas and characteristics of Erewhonian society in order to lampoon the rigidity of their thought—the primary target of his critique of Victorian society. While most of the novel's critics work to pinpoint and describe the object of his lampoon and the methods of his satire, in their examination of the "Book of the Machines" chapters literary scholars generally betray their inheritance of the very dichotomy that he is ridiculing by choosing one of the two sides to the Erewhonian debate as correct. Sussman chooses the technological determinist view of the body machine relation—the Erewhonian machinist argument: "Beneath the whimsy, there is Butler's perception that technology rather than biology is the true measure of human potential. . . . Furthermore, the evolutionary metaphors give an almost scientific sanction to the common nineteenth-

century pro-machine argument that the machine has expanded the range of human possibility" (149). Ketabgian takes the technological determinist promise of increased human potential a step further to argue that *Erewhon* sees "the human body as intrinsically prosthetic" and "humans as already posthuman" (30, 31). She concludes, "Mocking the humanist intentions of its technophobes, Butler's novel shows how the agenda to isolate and to preserve humanness instead triggers its disintegration. *Erewhon* lampoons efforts to purify the human, and contrasts these mistaken attempts with the actual production and definition of humanness through its hybrid connection with the machine" (31). Ketabgian and Sussman each think that one side of the Erewhonian debate is obviously the target of Butler's critique while the other is obviously his foresight of their own postmodern reality.[3]

The broadest aim of this dissertation has been to intervene in how we think about Victorian attitudes toward technology and mechanization generally by exposing their ideological debts and industrial roots, thus foregrounding our inheritance of a dichotomy of approaches to the so-called "body-machine" relation. While this historical materialist project is methodologically distant from the majority of the critical work on the topic of "bodies and machines," which generally follows from Donna Haraway's cyborg politics and reaches toward post-human studies, I think that there is nonetheless a parallel between my project and Haraway's injunction, generally not emphasized in readings of

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[3] Critics generally agree that the best way to read the "Book of the Machines" is as a prediction of their own twentieth-century fears. Sussman writes, "The appeal of the 'Book of the Machines' to the modern reader is also in Butler's uncanny ability inadvertently to describe the twentieth century . . . the public fears of the twentieth century have caught up with his satire" (155-56). Fuerst endorses and builds on Sussman's reading: "*Erewhon* is remarkable for its insight about man-machine relationships and for its conceptual prescience, looking forward as it does to twentieth-century ideas intimately connected with a cybernetic revolution which has made the Erewhonian professor's extrapolations much more credible. . . . [H]e also displays a deep insight into possible organismic properties of machines, particularly with respect to reproductive systems and self-regulation" (42).

her "cyborg manifesto," regarding the centrality of social relations:

> Taking responsibility for the social relations of science and technology means refusing an anti-science metaphysics, a demonology of technology, and so means embracing the skillful task of reconstructing the boundaries of daily life, in partial connection with others, in communication with all of our parts. It is not just that science and technology are possible means of great human satisfaction, as well as a matrix of complex dominations. Cyborg imagery can suggest a way out of the maze of dualisms in which we have explained our bodies and our tools to ourselves. (181)

In "refusing . . . a demonology of technology" Haraway is arguing for an alternative to critiques of technology (typified by Herbert Marcuse), which maintain a dualism between body and machine and which champion a natural humanness as recourse against increasingly dominating technology. Contrary to that position, Haraway argues that a new form of freedom might lie in exploring the political potentials as well as pleasures that might lie in embracing the image of the cyborg. In our scholarly embrace of Haraway's cyborg imagery, however, we have lost sight of "the social relations of science and technology" which made the cyborg necessary in the first place. In entering a cyborg future, we have inadvertently perpetuated capitalist ideologies of progress. In our attempts to avoid accusations of a technophobic Luddism, we have failed to recognize both the body and the technologies of the labor process as sights of class struggle. While Haraway sees historical "machine/ organism relationships" since the seventeenth century as "obsolete, unnecessary" and identifies a unique opportunity opened by in the ways that twentieth-century "High-tech culture challenges these dualisms in intriguing ways" (177),

I see an alternate route that lies in historicizing the very emergence of these dualisms through the demystification of the social relations embedded in “the body machinic.”

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