Dear History and Theory of Capitalism Workshop,

Thank you for taking the time to read this draft. This is a version of the first chapter of my ongoing book manuscript, *Factories of Modernity: Political Thought in the Capitalist Epoch*. The project argues that the factory's early-modern forerunners were decisive stages for the development of political thought and the global economy across Britain and the Atlantic world from 1688 to 1807. I draw on this historical study to develop a conceptual framework for understanding contemporary capitalism that, among other things, questions the idea that advanced capitalist societies have entered a "postindustrial" phase in which the factory system has been displaced by knowledge-based services, immaterial labor, and digital technologies. This chapter in particular traces a set of midcentury discourses (the "postindustrial paradigm") in support of the view that factories disappeared from the manufacturing core of industrial capitalism after World War II. The following chapter, on Google data centers and Amazon's microwork platform (MTurk), challenges the "postindustrial paradigm" by turning to the ways in which digital labor today is organized through regimes of factory production and anchored in historical patterns of work discipline, capital accumulation, and extraction tied to the factory's long-running labor process. I'd be interested to hear your thoughts on potential ways to reshape this chapter into something that could stand on its own (without the argument I make in the following chapter)—maybe as an intellectual history of "postindustrial society" or something like that.

Thanks again for your time and I look forward to your comments and our discussion on Wednesday!

All best,
Lucas

Postindustrial Paradigms: Foretold Futures of the Factory in Midcentury Social Science

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Draft in progress, please do not circulate

In December 1932 *Fortune* magazine announced the impending end of industrial society.[1] Aptly titled "Obsolete Men," the article suggested that the engines which had powered industry for centuries, first by steam then by electricity, had been supplanted by new automatic machines, making some two million factory workers in the United States "obsolete." Two years earlier, the same publication had already hinted at this prospect in a celebratory portrait of a Milwaukee factory—A. O. Smith Corporation—that turned out 10,000 car chassis every day through a semi-automatic assembly line supervised by a few skilled engineers and mechanics.[2] According to the piece, automatic mills would transform not merely the way things were made, but also the nature of work itself. Smith Corporation, lauded by *Fortune* as "the most advanced single exhibit of the automatic function in the world," had done away with manual and menial work almost entirely.[3] The automatic factory, the author reckoned, was sure to end the scourge of menial workers; but in a more menacing respect it also threatened to "end industry itself—in the form that we have hitherto known it." From where *Fortune* and its editors stood, the outcome of automatic machines was nothing less than a full-blown transformation of modern society; it portended a world without poverty, drudgery, and waste in which the working day would be cut by half.[4] The advent of "automatic mills" and "automatic fabrication," the article concluded, would usher society into "the era of the engineer."

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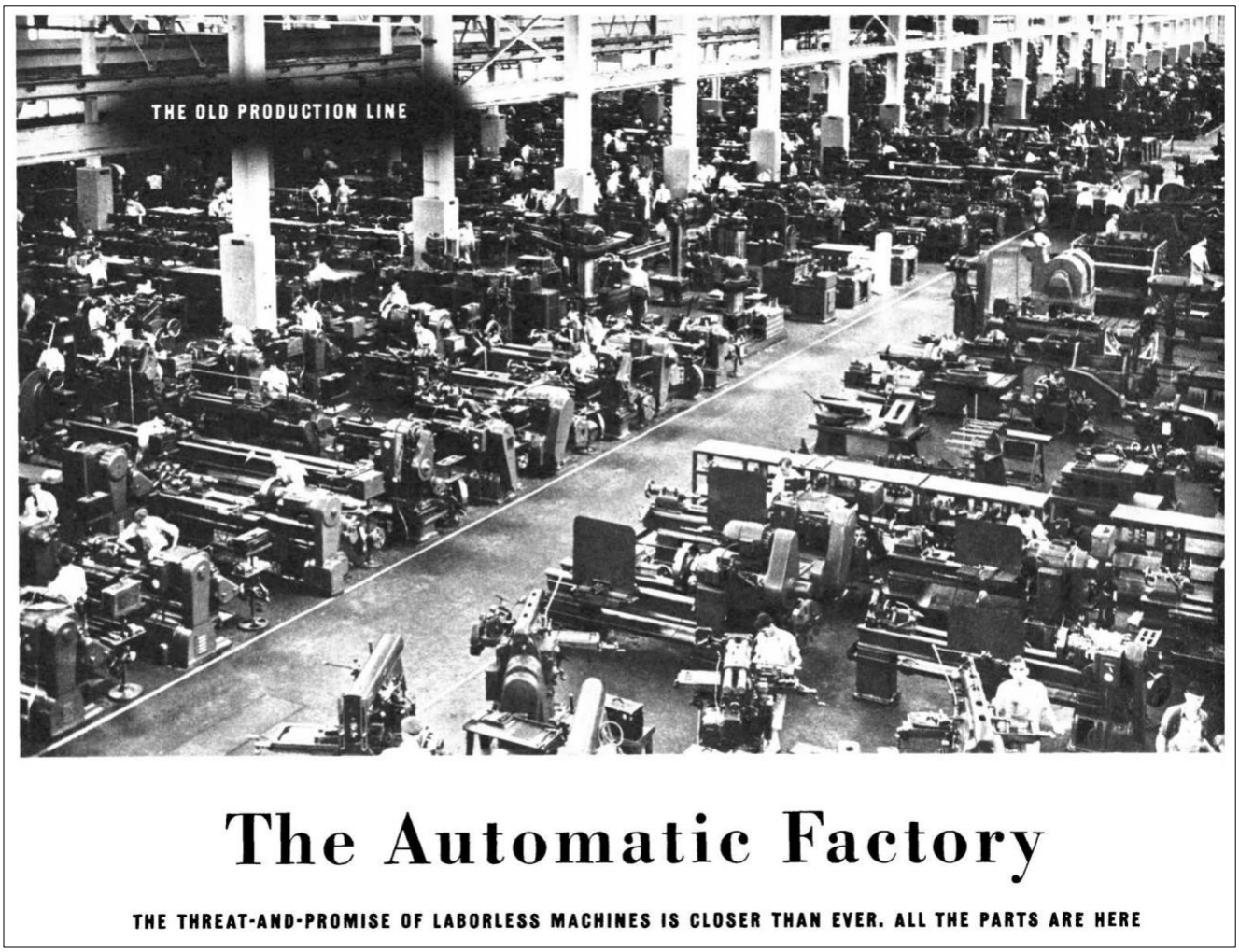
[1] "Obsolete Men," *Fortune*, December 1932.
[2] Stuart Chase, "Danger at the A. O. Smith Corporation," *Fortune*, November 1930.
[3] Ibid., 62.
[4] Ibid., 102.

Figure 1. A mechanical factory (c. 1946). International News Photos.
Source: "The Automatic Factory," *Fortune* 34, no. 5 (November 1946).



In 1946, *Fortune* doubled down on their earlier predictions in a lengthy portfolio entitled "The Automatic Factory" (Figure 1).[5] It led with a provocative headline: "The threat-and-promise of laborless machines is closer than ever. All parts are here" The spread included an editorial preface, full-color illustrations, and the article "Machines Without Men," written by two physicists engaged in wartime radar research, Eric Leaver and John Brown.[6] Their piece put forth a detailed vision of a fully automatic factory slated to usher society into a new machine age, "another industrial

[5] "The Automatic Factory," *Fortune*, November 1946.
[6] Eric W. Leaver and John J. Brown, "Machines Without Men," *Fortune*, November 1946.

revolution."[7] Above the production floor "barren of men," only "a few engineers, technicians, and operators walk about on a balcony." Facing a wall of electronic knobs and switches, these experts insert and check records, watch and adjust batteries of control instruments. They are also the only humans in sight—"all else is automatic." From the moment raw materials arrive at the factory they are placed under the guise of a continuous, automatic assembly line which manufactures these materials into a stream of finished commodities that are then packaged and loaded into delivery trucks before being shipped out to consumers—all without ever being touched by a single human hand.[8]

In addition to providing industries with lower costs, higher output, better products, and a faster rate of response to market fluctuations, an automatic factory system promised to yield significant benefits to society and the general public.[9] To make their vision a reality, the authors noted, would require changing the way people thought about, designed, and used machines, which, in 1946, was still predominantly determined by the mechanical, coal-and-iron technology of smokestack factories. "The new machines," they wrote, "will force society to find a better use for [workers] than to make them mechanical operators of machines."[10] Automation, they insisted, would create an unprecedented demand for skilled labor and drive society forward by developing the aptitudes, knowledge, and training of workers in addition to reducing their workload by half while raising their wages. As the story runs, the human workforce in an automatic factory would be composed of managers, charged with deciding what and how much to produce, and engineers tasked with carrying out management's decisions.[11] "Many of the ills of modern industrial society," Leaver and Brown contended, "can be traced in large part to the regimentation of workers," which

[7] Ibid., 165.
[8] Ibid., 199, 194–200.
[9] Ibid., 192.
[10] Leaver and Brown, "Machines Without Men," 165.
[11] Ibid., 200.

tends to "degrade the worker to an unskilled and tradeless nonentity" as well as to destroy their skills and initiative "without a compensating measure of economic security."[12] Their envisioned automatic factory would reverse this scenario by "demanding a highly skilled force of technicians and operators" while new electronic machines would "emancipate the worker forever from degrading or monotonous toll." The shocks associated with such a massive transition from an unskilled to a skilled factory workforce would be absorbed by training programs and an abridged workweek of only two or three days. Since this production system would be designed for a mass market, its economies of scale would be consequently "passed on in higher wages to the worker and greater value to the consumer," leading to "a higher level of living than ever before." In short, an economy that avails itself of this innovation, they concluded, "will be so different from the present it will constitute a new industrial order."[13]

This was certainly a radical and provocative proposal. But visions of automatic factories go as far back as the early nineteenth century. What distinguished *Fortune*'s version of automatic production from its foregoing equivalents was the claim that technological innovation would bring the factory system—as it was then known—to an end. By contrast, industrial thinkers in the 1830s believed the exact opposite to be true. On their view, the tendency of automation, or "self-acting machinery" as they called it, was rather to expand and prolong the industrial factory system. In his influential 1832 study of industrial technology, *On the Economy of Machinery and Manufactures*, Charles Babbage claimed in no uncertain terms that machines "lead to the establishment of large factories."[14] As he had it, the application of machinery to industrial production was "one cause of the great size of manufacturing establishments, which have increased with the progress of civilization."[15] Likewise,

[12] Ibid., 204.
[13] Ibid., 200.
[14] Charles Babbage, *On the Economy of Machinery and Manufactures*, 3rd ed. (London: Charles Knight, 1832), 213–14.
[15] Ibid., 213

Andrew Ure defined a factory in his 1835 *Philosophy of Manufactures* 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 subordinated to a self-regulated moving force."[16] "Self-acting" or "automatic" machines were central to Ure's optimistic outlook on the factory as both an agent of progress and a "grand palladium" to the material comfort of workers.[17] "The most perfect manufacturer," he argued in the entry to the term "Automatic" in his 1839 *Dictionary of Arts*, "is that which dispenses entirely with manual labour."[18] At the same time, most nineteenth-century industrial thinkers believed that the gradual rate of technological change in industrial society facilitated the slow expansion of the factory while preventing workers from being displaced by new machines in too great a number all at once. As William Cooke Taylor noted in his 1844 *Factories and the Factory System*, the effect of mechanical power has been "to *facilitate*, not to *supersede*, labour."[19] Since then, however, automated technology had advanced in full tilt, making breakthroughs that these thinkers could not have imagined much less foreseen. As the twentieth century ran its course, the prospect that newer, superior machines would leave millions unemployed in one fell swoop seemed inevitable.

While the industrial technology of the 1930s and 40s was certainly new, responses to its effect on unemployment took on a familiar, nineteenth-century tone. Much like Ure, Babbage, and Cooke Taylor, midcentury social scientists were convinced that workers had no reason to fear

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[16] Andrew Ure, *The Philosophy of Manufactures: Or, An Exposition of the Scientific, Moral, and Commercial Economy of the Factory System of Great Britain* (London: Charles Knight, 1835), 13–14.
[17] Ibid., 329.
[18] Andrew Ure, *A Dictionary of Arts, Manufactures, and Mines: Containing a Clear Exposition of Their Principles and Practice* (London: Longman, Orme, Brown, Green, & Longmans, 1839), 76. "AUTOMATIC, a term which I have employed to designate such economic arts as are carried on by self-acting machinery. The word 'manufacture' […] has now come to signify every extensive product of art which is 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."
[19] William Cooke Taylor, *Factories and the Factory System; from Parliamentary Documents and Personal Examination* (London: Jeremiah How, 1844), 3.

technology. This time around, however, the solution to the decline of industrial labor was not, as in the 1830s, the relative rise of new jobs in a rapidly expanding industrial sector, but the creation of an entirely new industry—the service industry. At the same time factory jobs began to slump in the early decades of the twentieth century, for instance, over half a million new positions were created in "the medical and allied professions, and in hotels, restaurants, moving pictures, and banking" while millions of laid-off industrial workers forged alternative careers in service repair and life-insurance, as chauffeurs and teachers.[20] These numbers confirmed the theoretical models of economists at the time, which predicted that "the machine would inevitably create as many jobs as it destroyed," or that, in lay terms, "even an automatic bulb maker which threw 10,000 men out of work would merely, in the long run, produce 10,000 surgeons or 10,000 insurance agents or 10,000 filling-station operatives or 10,000 poets."

But before its fruits could be reaped in society, the seeds of automation's alleged claim to progress and wealth had to be sown within the factory itself. That is, the transition from unskilled manual labor to skilled service, knowledge, and technical work—the indelible mark of postindustrial society—began in the automatic factory. For early automation enthusiasts, workers at automatic factories valued their work as "something different" and understood their jobs to be "far more independent and interesting than those in the hand mill."[21] In other words, the ennoblement of work made possible by automation, its advocates insisted, was as important as the economy of labor it purveyed. The advent of an automatic factory system set the stage for a postindustrial future. And that future, as the story goes, is our present moment.

Fortune's stories—of an emerging service industry and a new affluent society, of automatic factories teeming with amusing jobs, of poets and engineers—mark the early hours of two

[20] "Obsolete Men," 26.
[21] Chase, "Danger at the A. O. Smith Corporation," 62, 65.

developments that, within a decade, would come to symbolize a watershed in the histories of capitalism and the factory system: "automation" and "post-industrial society."[22] These stories index the emergence of various drawn-out discourses and debates about postwar capitalism—what I call the "postindustrial paradigm"—that first predicted then prematurely confirmed the displacement of the factory system by automated technology and a knowledge-based service economy. *Fortune*'s accounts of automatic factories and the "era of the engineer," dramatized though they were, offer a glimpse into how the conceit of a "post-industrial society" became the dominant lens through which technologists, entrepreneurs, social scientists, and critical thinkers have interpreted postwar capitalism as a radical break with its early modern and industrial pasts. But before we can unravel how and why the factory fell out of favor among industrialists, journalists, engineers, scholars, and the public at large we must first grapple with the central role the factory played in bringing about its own, allegedly fateful demise. As will soon become clear, the dawn of a postindustrial society had more to do with the factory than is generally believed. By engaging the shifting figurations of the factory in popular, scientific, and academic discourse on technological change following the Second World War, I contend that the political, cultural, and economic issues raised by the advent of automation and postindustrial society shed important light on the rise to prominence of the widely-held belief that the factory is neither a significant aspect of contemporary capitalism nor an important site for understanding or critiquing capitalist society.

This chapter traces a historical narrative of the ideas, inventions, and circumstances that register the factory's perceived obsolescence in a rapidly-changing world after 1945. In attending to diverse representations of the factory across a wide range of texts and traditions, from magazine articles and roundtables to classic works of midcentury social science and critical theories of

[22] I use the contemporary spelling "postindustrial" throughout unless it is a direct quote from or reference to a text, author, or period in which the term was conventionally hyphenated—most often as "post-industrial" and in rare occasions as "post-Industrial." Only in the latter cases the term will be in quotations.

capitalist society, I argue that the disappearance of the factory from leading accounts of contemporary capitalism is the governing feature of what I call the "postindustrial paradigm." I develop this argument in three sections, each on one instantiation of this paradigm: automation (Part 1), postindustrial society (Part 2), and critical theories of capitalism (Part 3). In so doing, however, I do not claim to punctuate the actual downfall of the factory, which never came to pass. Rather than the demise of real factories, I foreground predictions about its projected demise in the imaginations, models, and theories of engineers, entrepreneurs, and intellectuals. In short, I track the displacement of the factory by visions and metaphors of its foretold death—the uprooting of the industrial factory by its many postindustrial offshoots, from "automatic factories" in the 1950s to "social factories" today. And it is against the background of this powerful and dominant paradigm—put together by prophesies of an imminent future and theories of an interstitial present—that the ensuing chapters chart an alternative narrative of the factory's enduring relevance to the histories of political thought and the world economy, as much before as after industrial capitalism.

PART 1: AUTOMATION

After 1945, electronics and communications research undertaken during the Second World War brought to light and into circulation crucial developments in computer and machine technology as solutions to pressing problems of automatic control, lifting the idea of a fully automatic factory "from the realm of science fiction into that of serious discussion."[23] In the decade following the War, interest over the effects of automatic technology on society and its applications to industry grew at an unprecedented rate. Popular business magazines, such as *Fortune*, became staunch platforms for bringing the automation debate to public prominence. Meanwhile, numerous academic

[23] John Diebold, *Automation: The Advent of the Automatic Factory* (New York: D. Van Nostrand Company, 1952), 3. During the war, Smith Corporation, whose semi-automatic car-frame plant I discuss above, built a new factory that produced 500-pound aerial bombs for the US military at a rate of 1,000 per day. See "A. O. Smith at War," *Fortune*, October 1941.

articles and monographs on automated control systems were published in this period, notably Norbert Wiener's 1948 *Cybernetics*, in which he announced that society was on the brink of a "second industrial revolution" whereby the human brain would be replaced by machines. "The automatic factory and the assembly line without human agents," Wiener wrote, "are only so far ahead of us as is limited by our willingness to put such a degree of effort into their engineering."[24] As journalists, the public, and academics thought about and discussed automation, research institutes, at MIT and the University of Michigan, as well as corporations, such as Ford, General Electric, and IBM, made considerable strides in designing new automatic machines and applying them to mass production. But it was in 1952, with the publication of John Diebold's *Automation: The Advent of the Automatic Factory*, that the terms "automation" and "automatic factory" received their most thoroughgoing analytical treatment, marking the birth of the "automation movement." The popularity of cybernetics and automation among journalists, scientists, industrialists, and the general public also captivated the imaginations of midcentury thinkers. Martin Heidegger, for instance, stated in an interview from 1966 that "cybernetics was [a] form of technology replacing philosophy," while Hannah Arendt and Herbert Marcuse, commented explicitly on the social and political consequences of factory automation.[25]

Two key features of midcentury discourses about automation brought the movement squarely into the realm social and political thought: a focus on ideas and philosophy, on the one hand, and a concern with pressing social questions on the other. As Diebold put it in 1952, "automation can often be achieved only by *rethinking*," which he defined as an "attitude," or "an ability to get outside of a problem that seems insoluble and approach it in a new and perhaps wholly

[24] Norbert Wiener, *Cybernetics: Or Control and Communication in the Animal and the Machine*, 2nd ed. (1948; repr., Cambridge: MIT Press, 1961), 27.
[25] Martin Heidegger, "Nur Noch Ein Gott Kann Uns Retten," *Der Spiegel*, May 31, 1976. Quoted in Brian Simbirski, "Cybernetic Muse: Hannah Arendt on Automation, 1951–1958," *Journal of the History of Ideas* 77, no. 4 (2016): 596–97. The interview was conducted in 1966 and published in 1976.

different way."[26] He insisted that, before automation can be practiced and applied, it must be understood as a philosophy for "it is a way of thinking as much as it is a way of doing."[27] Indeed, automation, he discerned, was "a new *concept*—the idea of self-regulating systems—and a new set of principles." The full benefits of automation in society required political, industrial, and labor leaders to understand it as a social and political theory. Yet, as we have seen with Babbage and Ure, neither was the idea of self-regulating systems particularly original nor was Diebold's focus on philosophy entirely new.

Theories of management, based on new scientific and social models of production and governance, had already been proposed by the likes of Frederick Taylor and Thorstein Veblen in the early twentieth century.[28] Still, as much in theory as in practice, early advocates of automation thought of their plan as decidedly distinct from Taylor's and Veblen's insofar as their aim less to reform management and production than to reimagine the factory system and its meaning to society. And it is precisely in this sense—in light of its theoretical and social force and its promise to transform society—that automation was widely defined as a "new industrial order."[29] Although in the mechanical factory system, propelled by the steam engine and the electric motor, "human physical labor is replaced by machine power," in the automatic factory, called to motion by self-regulating systems and computers, "the monitoring and control tasks now humanly performed," Diebold wrote, "will be done by machines."[30] Automation was thus the name given to the highest level of industrial mechanization; if the technological differential of the Industrial Revolution was

[26] Diebold, *Automation*, 45.
[27] John Diebold, *Beyond Automation: Managerial Problems of an Exploding Technology* (New York: Praeger, 1970), vii.
[28] Frank K. Shallenberger, "Economics of Plant Automation," in *Automation in Business and Industry* (London: John Wiley & Sons, 1957), 549.
[29] David F. Noble, *Forces of Production: A Social History of Industrial Automation* (New Brunswick and London: Transaction Publishers, 2011), 69.
[30] Diebold, *Automation*, 140.

power, that of the second was control. From James Watt and Richard Arkwright's steam engine in 1763 to the Colossus Computer in 1943, the factory was a key site where theories and ideas converged with practice, and out of which new organizations of industrial society were born.

While the focus of automation was at first on manufacturing, the movement's insistence on the "automatic *factory*" can be misleading given what many of its advocates understood by the term "factory." The automatic factory they envisioned was decidedly not a manufacturing plant; in fact, as Diebold saw it, automation would be hardly applicable to manufacturing industries.[31] Rather, the effects of automation would be more "spectacular and far-reaching" in the "information-handling functions of business."[32] Indeed, some of Diebold's most detailed illustrations of automation pertain less to the assembling of materials than to logistics, to the organization, processing, and flow of goods and data across the supply chain. Automation would thus be most useful to offices, insurance firms, small companies, and even the trading floor of the New York Stock Exchange; it would facilitate such tasks as transportation, accounting, ordering and inventory control, business management, and operations research.[33] "While 'Detroit Automation' may be peripheral," he observed, "control and information technology is at the heart of the truly significant part of the automation development."[34] This was a retort to what Diebold derided as a public hysteria over technological unemployment. When applied to informational tasks and services, "mechanization rarely replaces labor, for the process does not become entirely automatic."[35] Rather, "automatic machines will make it possible to render new, more comprehensive and more economic services."

[31] Ibid., 142.
[32] Ibid., 144.
[33] Ibid., 93, 108–10, 112–13; 94–95; 46–50; 101–4; 116–18; 121–22; 122–26.
[34] John Diebold, *Man and the Computer: Technology as an Agent of Social Change* (New York: Praeger, 1969), 134.
[35] Diebold, *Automation*, 143.

As such, the forecasted effect of automation was to accelerate and continue "the present trend toward expansion of the service industries in relation to other industries."[36]

At the same time, when applied to production, automation promised to eliminate the debasement of workers and their subjugation to machines. Diebold recognized that in a typical factory, machines tended to subordinate workers and deprive them of making any creative contribution to their work.[37] He agreed with previous advocates of automation—such as Leaver and Brown in *Fortune*—that much of the "psychological unrest and discontent in industry" ensues from "the attempt to adjust the worker to the machine that paces him and, in a broader way, of the mechanistic concept of the function of workers in *mass production*."[38] By contrast, automatic machines handle all repetitive and dreary tasks, so workers will be free to engage only in those activities—inside and outside the workplace—that demand and develop their "inherent human capacities."[39] Diebold's suggestion was not that every factory worker would become a skilled engineer, but rather that they would be "happy or happier performing tasks that use their abilities more fully."[40] The counterintuitive twist of automation, Diebold had it, was that, rather than expediting an anticipated future of work, it would "bring us back to the human and psychological values of the self-respecting craftsman."[41] Mechanical and electrical repair work, he insisted, "can provide challenges, pleasures, and satisfactions very much like those enjoyed by the swordsmith or cabinetmaker of old." Highlighting the "personal challenges" and "the great self-respect" mechanics "enjoy" as well as "the respect they earn from their fellow workers," Diebold held that automation would add a

[36] Ibid., 144.
[37] Ibid., 159–60.
[38] Ibid., 160–61.
[39] Ibid., 162, 163.
[40] Ibid., 163.
[41] Ibid., 164. See also C. Wright Mills, "The Unity of Work and Leisure (1954)," in *Power, Politics and People: The Collected Essays of C. Wright Mills*, ed. Irving Louis Horowitz (New York: Oxford University Press, 1963), 348–49, 383–84.

significant affective premium to factory work. But as the corporations who would eventually develop and apply this technology made clear, the human side of automation was only an afterthought—the stuff of public relations and marketing.

In 1953, *Fortune* hosted a roundtable between sixteen experts on the automatic factory. Among the participants were representatives from companies with a large stake in its implementation, notably Ford, General Motors, IBM, and General Electric, as well as an expert on servomechanisms from MIT (William Pease), an eminent sociologist from the University of Chicago (David Riesman), and the authors of the 1946 piece "Machines without Men" (Leaver and Brown).[42] The roundtable was introduced by the moderator as a discussion on "the Second Industrial Revolution."[43] The participants agreed that both the technology and social conditions necessary to implement their vision of a fully automatic factory were already. In light of ongoing shortages in labor supply, they reckoned the coming decade would "provide industry with an ideal opportunity to go all out on automatization." As a representative from General Electric put it, "we don't think [automation] is experimentation. We think it is coming."[44] Two important aspects of this debate anticipated the key transformations of postindustrial society: the replacement of manual labor by machines and the displacement of skilled labor by computers.

The role of the computer raised an important question for the automatic factory, one that is now at the center of ongoing debates about digital labor, namely, whether machines are able to replicate more intricate human tasks tied not only to reason but also to judgment, sense, and emotions.[45] This idea was likely to be familiar to *Fortune* readers from two articles published in 1949,

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[42] "The Automatic Factory: A Fortune Roundtable," *Fortune*, October 1953.
[43] Ibid., 168.
[44] Ibid., 169.
[45] On popular treatments of this prospect at the time, see Edmund Berkeley, *Giant Brains, or Machines that Think* (New York: John Wiley and Sons, 1949); Wiener, *The Human Uses of Human Beings: Cybernetics and Society* (1950; repr., London: Free Association Books, 1989).

which suggested, respectively, that the computer would be the artificial brain of a new industrial order and the key to the automatic factory.[46] In one of these pieces, titled "Mechanical Brains," the author reiterated Wiener's well-known postulate: "while the first industrial revolution involved the substitution of machinery for man's musculature, the second will replace by inanimate devices man's senses, nervous system, and brain."[47] Four years later, the moderator of the automatic factory roundtable repeated the axiom: "The first revolution, still continuing, mechanized manufacturing processes. The second will automatize them; i.e., it will remove man from the manufacturing operation itself and relegate him to maintenance and supervisory roles."[48] There is, however, a subtle yet significant distinction in these two formulations of the second industrial revolution, one economists would describe in terms of "replacing" and "enabling" technologies.[49] In the former, even the most skilled workers would be replaced by the computer; in the latter, technology would offer skilled workers a new opportunity for exercising and improving their expertise. To put it differently: while the automatic factory promised to make human work more enjoyable and skilled, the computer threatened the skilling of labor by surpassing—and eventually replacing—humans in their key competitive advantage over machines, namely, their intelligence, emotions, taste, and judgment. As noted by the founder of Cross Company, which specialized in automatic transfer machines, "If we could find some way of doing mechanically what the man does now, that is, looking, listening, feeling […], we would be able to take a big step forward."[50] In short, "it seemed obvious that [computers] ought to fit into the Automatic Factory somewhere. But where?"[51]

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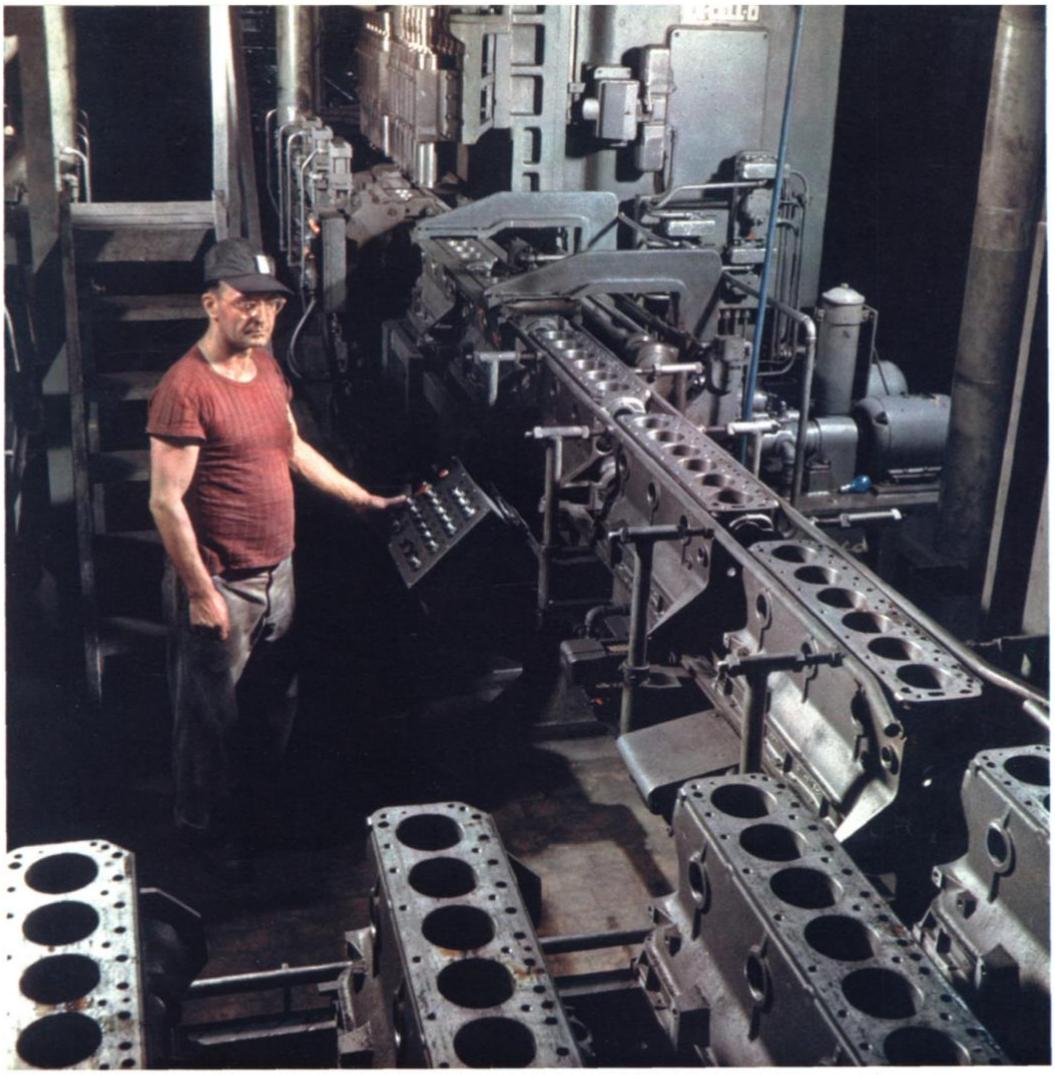
[46] Louis N. Ridenour, "Mechanical Brains," *Fortune*, May 1949; "A Key to the Automatic Factory," *Fortune*, November 1949.
[47] Ridenour, "Mechanical Brains," 117.
[48] "The Automatic Factory: Roundtable," 168.
[49] Frey, *The Technology Trap*, x; Daron Acemoglu and Pascual Restrepo, "Artificial Intelligence, Automation and Work" (Massachusetts Institute of Technology, Department of Economics Working Paper Series, Cambridge, 2018).
[50] "The Automatic Factory: Roundtable," 187.
[51] Ibid., 188.

Figure 2. A worker stands next to Ford's automatic production line in Cleveland, Ohio (c. 1953). Source: "The Automatic Factory: A Fortune Roundtable," *Fortune* 48, no. 4 (October 1953).



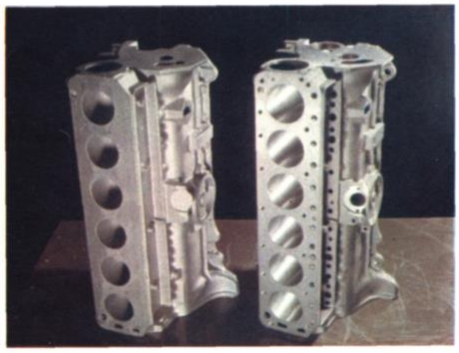
A lonely job setter on the Ford engine-block line waits for the Second Industrial Revolution to replace even him

Ford calls it automation

The most complex series of automatic machining operations in America today is probably the one above, conceived by Ford to turn rough castings into finished cylinder blocks (see right). This prodigious "automatic factory" for making six-cylinder blocks occupies about one acre of Ford's new $30-million Cleveland foundry and engine plant.

The blocks are transported automatically—by a process Ford calls "automation"— into and out of twenty-odd different machines that perform a grand total of 532 broaching, milling, boring, honing, drilling, and tapping operations. Virtually the only men required on the automated line are job setters, who keep a sharp eye on the process and replace worn tools whenever a "toolometer" (opposite page) indicates a tool is nearing the end of its life expectancy.

Automation ends with machining. Assembly of the engine is left to the inscrutable coordination of the human hand and eye.



Engine blocks: transformation by automation

Photographs by David E. Scherman

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The debate over the role of computers in the automatic factory brought to light the possibility that automation could be a threat not only to assembly-line operatives, but to skilled workers as well. For companies investing in automation at the time, the best attainable solution to public anxieties over technological unemployment was to spin the problem as a blessing, as an "enabling" rather than "replacing" technology. No company understood this better than Ford, which had then just begun production in its new automatic factory in Cleveland (Figure 2)—the very site where the term "automation" was coined by the company's Vice President of manufacturing D. S. Harder.[52] As a Ford representative at the roundtable put it: "a better selling job has to be done on the social desirability of increased mechanization."[53] This is precisely what Ford attempted to do in a promotional film titled *Technique for Tomorrow* (1953). In introducing the company's application of automation at its Cleveland foundry, the video sought to generate excitement over automation's marvels while mitigating the public's fear over its possible displacement of labor. As the narrator put it: "At first it looks like the machines are doing it all alone. That's the automation. But look around the other side and you will see the men. It takes men to keep these machines running."[54] The crux of the message conveyed through the voiceover is precisely on the skilling of labor made possible by automation, its enabling and ennobling effects:

> There's no end to the opportunities for [workers] in new plants like these. They're not all in production work either. You'll see them in the powerhouse; on duty at the gates; they work in the metallurgy laboratory; they run complicated tests on metal and sand […]. Everybody plays a vital part: the doctor and the nurses in the hospital; the girls on the switchboard; the men in the employment office; everyone.

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[52] Diebold, *Automation*, ix. Interspersed with the roundtable piece, *Fortune* printed a full-page and full-color advertorial on Ford's new Cleveland plant (Figure 2). The caption beneath the operator reads: "A lonely job setter on the Ford engine-block line waits for the Second Industrial Revolution to replace even him." See "The Automatic Factory: Roundtable," 171.
[53] Ibid., 190.
[54] Jerry McMechan, *Technique for Tomorrow*, 16mm, Corporate Video (Office of Public Relations, Ford Motor Company, 1953), https://www.youtube.com/watch?v=PdIVK3R7JDI.

According to Ford, the automatic factory was a storehouse of new ideas, new machines, and above all new skills. This is related in the video through the life stories of real employees at the plant. Menial workers in the assembly line, we are told, have the opportunity to enroll in one of Ford's many training programs where they receive expert instruction and, in a matter of a few months, can be promoted to better-paying positions that demand more skill, autonomy, and responsibility. As the film tells us, nearly half of all supervisors are trained in the factory, many of whom have risen through its ranks. And by way of a technical apprentice curriculum, young workers are instructed in "the trades of tomorrow as of today" and afforded "a bright future in modern industry" as "experts in a profession of their choice." Juxtaposed by footage of workers leaving the factory, the narrator pivots to the conclusion, summarizing the crucial takeaway from the wonders of automation: "The men are the most important part of these plants. No matter how complex the machines, how miraculous their achievements, it takes men to run them and to keep them running, just as it took men to dream them up in the first place." As workers exit the factory's production line, classrooms, and offices, they converge in the parking lot where it is made clear that all of them—regardless of their position in the company—are able to afford a model of the cars they helped to build. By setting "the pattern for future industrial progress," the film continues, Ford is producing far more than engines; what is made and sold here, the narrator insists, is "a new way of industrial life." The film ends with the footage of a worker driving past the factory gates after his shift while many of his colleagues are still inside. The factory in the background remains in full tilt, suggesting that, thanks to automation (and workers' overlapping shifts), production never stops. As the narrator concludes, "It is still early morning in America, dawn of a new day in industry."

The idea that automation was emphatically dependent on human labor, vividly conveyed by Ford's marketing campaign, endures in the present. This is one of the main reasons why so much of the menial data labor performed on the internet today—especially in content moderation and

microwork—is overwhelmingly performed by humans rather than algorithms. Instead of "automation," then, the transformations in contemporary digital labor have been termed "heteromation," or the automation of human emotional, sensory, and cultural labor by humans themselves.[55] While early advocates of automation conceded that automation could displace some workers, they insisted that it would also wipe from the face of the economy all forms of drudgery, boredom, and physical exertion. The lives of workers will be more meaningful and enjoyable as a result. Human progress is thus the indelible yield of scientific achievement and technological innovation.[56] Were computers capable of performing the sensory, emotional, and cognitive labor of human beings, the prohibitive costs of such technology would be a safeguard against its application in the automatic factory.

For Diebold, the computer could not possibly replace human intelligence, emotions, and judgments. He was a harsh critic of Wiener, Berkeley, and other thinkers associated with cybernetics for anthropomorphizing the computer through animal-machine analogies in which the human and animal nervous system were deceptively likened to automatic electronic networks.[57] While the computer's capacity to solve mathematical problems resembled processes of human thought, "the resemblance is too superficial to warrant the conclusion that these machines *think* or are in any essential way *human*."[58] And, as Diebold pointed out, the fundamental human abilities to think, feel, and judge, along with our free will, autonomy, and agency, set us apart from computers; they are unsurmountable barriers to the so-called human-machine continuum, which no computer is able to cross. Insofar as the automatic factory is concerned, Diebold's answer was unambiguous: "We want

[55] Hamid Ekbia and Bonnie Nardi, "Heteromation and Its (Dis)Contents: The Invisible Division of Labor between Humans and Machines," *First Monday* 19, no. 6 (2014), http://firstmonday.org/ojs/index.php/fm/article/view/5331.
[56] Norbert Wiener, "Men, Machines, and the World About," in *The New Media Reader*, ed. Noah Wardrip-Fruin and Nick Montfort (Cambridge and London: MIT Press, 2003), 71.
[57] Diebold, *Automation*, 153–57.
[58] Ibid., 154.

flexibility in our machines, of course. We want multi-purpose machines, too. But the maximum degree of flexibility that could be industrially useful and economical falls very far short of anything even remotely approaching the fully human machine."[59] In his ideal scenario, if automation does anything to the human-machine relation, it is to make humans more distinct from computers by improving their uniquely human attributes and standard of living—not just in the workplace, but in all spheres of life. "The *upgrading* of labor that will accompany automation," he argued, "will not be limited to the acquisition of mechanical skills but will be a rounded process of fuller development of the whole man."[60] But this in turned raised a social and cultural problem. To the extent that it provides "more satisfying jobs that allow fuller human development, automation will heighten the problem of *leisure*."[61] Despite noting that this is "one of the most basic problems of our day," Diebold does not offer an answer as to whether Americans were "capable of developing a culture that does not depend upon work to give meaning to [their] lives."[62] Indeed, the cultural transformations set in motion by the changing character of work predate the displacement of labor by technology and have accompanied the development of the factory system since the eighteenth century.

In the 1950s, the cultural problem posed by automation generated ample debate about what kind of society would ensue if all menial labor were to vanish and humans were required to work for only a fraction of the time they had been accustomed to. The scientist Richard Meier, whose work on the economy Diebold held in high esteem, agreed that automation would transform the menial factory worker into "a programmer, an overseer, a maintenance mechanic, or a salesman" and, as result, make human labor more fulfilling, flexible, and skilled.[63] Yet, Meier added, because this will

[59] Ibid., 156.
[60] Ibid., 164.
[61] Ibid., 165.
[62] Ibid., 165–66.
[63] R. L. Meier, "Automatism in the American Economy," *The Journal of Business* 29, no. 1 (1956): 24–25.

"require marked improvements in education, health, and community organization, not only in automated activities but in all those which are closely related," it is "difficult to see any leisure at all being provided by the transition to automation." Rather, he claimed that the liberation workers would experience as a result of automation is far more likely to take on a psychological character. That is, while workers will behave "as if they were their own bosses," they will probably work just as long in a fully automated society as they had before, "until the culture itself changes."[64] For Diebold, however, automation *was* effectively and in essence a change in the culture. "What has always made machines truly important," he argued in 1969, "is not their individual versatility and productivity—it is the fact they serve as agents of social change. They change our world. They change us."[65] In comparison to the social, political, and economic revolution occasioned by the cotton gin, the power loom, and the railway in the nineteenth century, Diebold suggested that automatic machines would "change society much more rapidly and profoundly […] because they deal with the stuff of which society is made—information and its communication."[66] In altering the means of communication, automation transforms the cultural fabric of modern society. And nothing illustrated the extent of this potential for change better than automation's effect on leisure.[67] Automation was a revolution that would "take us *beyond* the civilization of an industrial society" and towards a world in which human beings are "largely freed from the bondage of machines," "fewer and fewer people work in factories," "the work week is greatly shortened," and, above all, "leisure becomes the center of life, rather than the fringe."[68]

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[64] Ibid., 25.
[65] Diebold, *Man and the Computer*, vii.
[66] Ibid., 3–4.
[67] Ibid., 4; Diebold, *Beyond Automation*, 28.
[68] Diebold, *Beyond Automation*, 118–19; Joint Economic Committee, "New Views on Automation," Papers Submitted to the Subcommittee on Automation and Energy Resources, 86th Congress of the United States, 2nd Session (Washington: United States Government Printing Office, 1960); Joint Committee on the Economic Report, "Automation and Technological Change," Congressional Hearings Before the

According to David Riesman, the only social scientist at *Fortune*'s roundtable on the automatic factory, the problem of leisure would be one of the key impediments to automation in the twentieth century. Just three years earlier, Riesman published a landmark study on the social character of Americans titled *The Lonely Crowd*.[69] Among its claims, the book suggests that the temperament, mentality, identity, and attitudes toward consumption, leisure, and work among middle-class Americans had been radically transformed since the Industrial Revolution. The shift in values from the sphere of production to consumption, along with the mass transition of labor from industry into service, gave form to what Riesman dubbed an "other-oriented" social character. It was especially within the realm of mass consumption and a new professional setting which blurred the traditional divide between work and play, that middle-class Americans came to pursue personal fulfillment and construct their identities. Based on this interpretation, Riesman raised an alternative optimistic prospect for the automatic factory: its promise to relieve workers from the emotional hazards of work. Since he believed that middle-class Americans had recently come to view leisure as a liability, rather than an asset, and because they found in work those gratifications formerly attached to play, Riesman saw automation as a potential remedy to the affective and psychological strains of an increasingly service-based economy. Referencing William F. Whyte's research on the restaurant industry, in which this emotional form of workplace hazard is conveyed in the image of a crying waitress, Riesman defended automation as a check on the affective toils of postindustrial work.[70] "When I see an Automat," he declared, "I would like to bow down and salaam to it as a blessing, because it gets rid of the crying waitress."[71] Yet, he warned the scientists, businessmen, and

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Subcommittee on Economic Stabilization, 84th Congress of the United States, 1st Session (Washington: United States Government Printing Office, 1955).

[69] David Riesman, Nathan Glazer, and Reuel Denny, *The Lonely Crowd: A Study of the Changing American Character* (New Haven: Yale University Press, 1950).

[70] William Foote Whyte, "The Social Structure of the Restaurant," *American Journal of Sociology* 54, no. 4 (1949): 302–10.

[71] "The Automatic Factory: Roundtable," 190.

engineers at the roundtable that the more unappeasable resistance to the automatic factory would be formed by this very class of service workers, many of whom, he believed, had "a vested interest in their miseries" and "a masochistic need to work too hard."[72] The question here was whether automation could deliver its promise of a more fulfilling life in a society where contentment was so intrinsically enmeshed in their job, salary, and discretionary income.

As I have shown, the automatic factory was at the heart of a significant debate concerning the relationship between technology and society. And the problem of leisure—of a society that saw no role for itself beyond labor—was at the center of the automation debate. Moreover, the various social and political problems raised by the advent of automation were not only of interest to scientists, engineers, and managers; they were equally important to a wide range of midcentury thinkers.[73] Hannah Arendt, for instance, famously noted that the social consequences of modern scientific achievement imperiled the foundations of human life, politics, and culture. The growing "technicalization of our world," she wrote in the preface to *The Human Condition*, could end by destroying all life on earth through total nuclear war or by rendering speech, the source of our political being, void of all meaning.[74] But perhaps a more imminent—"equally decisive" and "no less threatening"—prospect of modern technology was, as she put it, "the advent of automation, which in a few decades probably will empty the factories and liberate mankind from its oldest and most natural burden, the burden of laboring and the bondage to necessity."[75] Yet, Arendt immediately dispelled the possibility that automation could be liberating. In a society where labor is exalted above all other higher and more meaningful activities, the threat of automation is rather that it would

[72] Ibid., 190–95.
[73] On Arendt and Heidegger, see Simbirski, "Cybernetic Muse," 590.
[74] Hannah Arendt, "Europe and the Atom Bomb (1954)," in *Essays in Understanding, 1930-1954*, by Hannah Arendt, ed. Jerome Kohn (New York: Harcourt Brace, 1994), 418–23; Hannah Arendt, *The Human Condition*, 2nd ed. (1958; repr., Chicago and London: University of Chicago Press, 1998), 3–4.
[75] Arendt, *The Human Condition*, 4.

deprive humans of the only activity left to them—labor. For her, the danger of automation inheres in its promise to create "a society of laborers without labor." And surely, she concluded, "nothing could be worse."[76] By engaging with Diebold's *Automation* across her chapter on work, Arendt highlights that the automation movement tried desperately to rescue the psychological and human values of the self-respecting craftsman by focusing on technology's promise to eradicate drudgery and thus transform labor into a skilled and fulfilling activity. Arendt derides the naiveté behind such a project, pointing out that, although workers in a factory—be it mechanical or automatic—may have excellent reasons for self-respect, "it certainly cannot arise from the work they do."[77] And as the discourse around the automatic factory makes plain, that was precisely what its proponents had hoped for: to replace "the interest in work and the satisfaction of craftsmanship" by "human relations" and by the respect workers "earn from their fellow[s]." As much for *Fortune* as for Diebold, the irresistible appeal of the automatic factory was not that it would put an end to human work, but that it would sacralize work as a source of human fulfillment.

In its capacity as a site of technological and cultural transformations, as a battlefield of theoretical disputes and as a stage in which people thought about and pursued change, the automatic factory of the 1950s register the social clout of ideas in the period. Whether a utopian or doom-laden vision of the future, a factory without workers was then only a vision of the future. But the very prospect of such a vision helped to shape some of the most emblematic developments of postwar capitalism. In the intellectual realm, the automatic factory was a focal point of the discourses—on labor and leisure, economic growth and cultural decay—that characterized midcentury debates about automation and technology. In the sphere of technological innovation, it was a testcase for the application of autonomous control systems to manufacturing and a catalyst for

[76] Ibid., 5.
[77] Ibid., 149n12.

advances in electronic computing. And in the economic domain, it was a model for Arnold Beckman and William Shockley's production of silicon semiconductors in 1956, marking the dawn of that paradigmatically postindustrial place we now know as Silicon Valley.[78] As such, the automatic factory paved the road for visions of a society not only fundamentally different but dramatically severed from its industrial past. Indeed, as I argue next, the advent of a "new economy" in which knowledge, machines, and services replaced the drudgery of manual labor was carried forth into the latter half of the century by a number of sociologists and economists. But rather than merely envisioning or anticipating the demise of the factory, as automation thinkers had done in the 1950s, social scientists of the 1960s and 70s watched it come apart—or so they have told us. What they claimed to have predicted then witnessed was the emergence of a postindustrial society.

PART 2: POSTINDUSTRIAL SOCIETY

While the phrase "post-industrial society" is widely associated with Alain Touraine's 1969 *The Post-Industrial Society* and Daniel Bell's 1973 *The Coming of Post-Industrial Society*, the term had been employed by David Riesman in 1958 as well as by other social scientists, including Bell himself, since the late 1950s.[79] Likewise, although the concept of "postmodernism" is generally attributed to art historians, cultural theorists, and literary critics the likes of Ihab Hassan, Charles Jencks, Jean-François Lyotard, and Fredric Jameson, it too had been used by social scientists through the 1950s, including by C. Wright Mills in 1959.[80] The widespread circulation and influence of these terms,

[78] David C. Brock, "From Automation to Silicon Valley: The Automation Movement of the 1950s, Arnold Beckman, and William Shockley," *History and Technology* 28, no. 4 (2012): 375–401.
[79] Bell borrowed the phrase "post-industrial society" from David Riesman, "Leisure and Work in Post-Industrial Society," in *Mass Leisure*, ed. Eric Larrabee and Rolf Meyersohn (Glencoe, IL: The Free Press, 1958), 363–85. See also Margaret A. Rose, *The Post-Modern and the Post-Industrial: A Critical Analysis* (Cambridge: Cambridge University Press, 1991), 22–25, 169–71; Krishan Kumar, *From Post-Industrial to Post-Modern Society: New Theories of the Contemporary World*, 2nd ed. (1995; repr., Oxford: Blackwell Publishing, 2005), Chapter 2.
[80] For Mills's use of the term, see C. Wright Mills, "Culture and Politics (1959)," in *Power, Politics and People: The Collected Essays of C. Wright Mills*, ed. Irving Louis Horowitz (New York: Oxford University Press, 1963),

which indexed a turning point in the histories of industrial society and modernity alike, were of a piece with midcentury debates about automation and the automatic factory. Throughout the 1960s and 70s, the factory remained central to how social scientists understood, explained, and characterized the momentous shifts in advanced capitalist societies since the Second World War. As the development of automation—and its perceived threat to industrial capitalism—continued apace, a range of scholars across sociology, political science, and economics departments turned their attention to some defining aspect of this new society as a means to unravel a plurality of transformations that ran the gamut from the economy and culture to politics and technology. Whether they chose to label it "post-industrial," like Riesman, Touraine, and Bell, or "affluent," like Kenneth Galbraith and Gunnar Myrdal, was less important than the fact that, whatever this society had become, whatever it was called, they all agreed that it was decidedly and irrefutably different from what it had been just a few years back.[81] Although the automation debate of the 1950s was explicitly associated with—and in some regards even bound by—the future of the factory and its workers, the architects of the postindustrial turn cast a far broader net over the general significance of technological progress, arguing strongly that its effects accounted for a total overhaul of industrial society and modern life. But insofar as the factory is concerned, "post-industrial society" continued what automation had begun; it brought to bear, as the story runs, a prospect over which automation enthusiasts had mused for decades: "to make possible factories without workers."[82]

236–46; C. Wright Mills, *The Sociological Imagination* (1959; repr., Oxford and New York: Oxford University Press, 2000), 166, 180, 183. See also Rose, *The Post-Modern and the Post-Industrial*, 171–75, 180n1.

[81] John Kenneth Galbraith, *The Affluent Society* (Boston: Houghton Mifflin, 1958); Gunnar Myrdal, *Challenge to Affluence*, Expanded and Revised (1963; repr., New York: Vintage Books, 1965). See also Howard Brick, "Optimism of the Mind: Imagining Postindustrial Society in the 1960s and 1970s," *American Quarterly* 44, no. 3 (1992): 357–59.

[82] Daniel Cohen, *Three Lectures on Post-Industrial Society*, trans. William McCuaig (2006; repr., Cambridge and London: MIT Press, 2009), 34.

If the phrase "post-industrial society" is readily recognized today as a paradigmatic expression of our time, then this is in large part thanks to the work of Daniel Bell. Through a series of notable essays, edited volumes, and monographs published between the mid 1950s and early 1970s, Bell developed a far-reaching theoretical account of the key political, economic, and cultural developments that had, since the Second World War, unmistakably altered American society.[83] In this sense, his 1973 book, *The Coming of Post-Industrial Society*, may be read as the culmination of a sustained inquiry into the shifting character of modern life, a synthesis of the various changes he had written about and lived through in the previous two decades. The end-result was an account of a society so essentially at odds with its industrial past as to warrant a new modifier: "post-industrial." Indeed, "post-industrial society" was to Bell what the factory system had been to Ure and Babbage or what automation was to Diebold: a rupture with the past, a transformation of the present, and a path to the future. For Bell, the break, change, and promise for which "post-industrial society" stood were summed up in two related shifts: in the *material* realm, it represented "a changeover from a goods-producing society to an information or knowledge society" and, in the *intellectual* sphere, it implied "a change in the axis of abstraction from empiricism or trial-and-error tinkering to theory and the codification of theoretical knowledge for directing innovation and the formulation of policy."[84] Whichever way he cut it, the factory as it was then understood had no place in a "post-industrial society."

In the late 1950s, Bell began to seriously entertain the possibility that technology was leading modern society further and faster astray from its foregoing, industrial course of economic

[83] On the intellectual and social contexts of Bell's thought leading up to this period, see Howard Brick, *Daniel Bell and the Decline of Intellectual Radicalism: Social Theory and Political Reconciliation in the 1940s* (Madison: University of Wisconsin Press, 1986).
[84] Daniel Bell, *The Coming of the Post-Industrial Society: A Venture in Social Forecasting* (1973; repr., New York: Basic Books, 1999), 487.

development.[85] Before *The Coming of Post-Industrial Society* appeared in 1973, he developed this theory through a stream of lectures, conference papers, and articles from 1959 to 1967. During this time, a range of social scientists also turned their attention to the transitions already afoot in American society, describing its distinctively new spirit by focusing on diverse aspects of change, including the growth of affluence, the rise of mass leisure, the emergence of a knowledge economy, and the shift from manufacturing to services.[86] The sense that the industrialized world was on the verge of a "great transformation" was pervasive, but whether this was a "post-capitalist" society, as Ralf Dahrendorf suggested in 1959, or, as Walt Rostow put it in 1960, a "post-maturity" economy, was still unclear. While Bell's understanding of "post-industrial society" was neither an all-out departure from capitalism nor simply another stage of economic growth, it nonetheless conformed to the general consensus of the age: "we are in the midst of a vast historical change."[87] Rather than an autopsy of the past and a vision of the future, Bell's idea of "post-industrial society" is better understood as a diagnosis of the present, an articulation of a virtually ubiquitous postwar feeling of—as he aptly put it—"living in interstitial time."[88] Leaving aside its grand claims of a third technological revolution and the reshaping of economic life, we may come to see Bell's "post-industrial society" as an expression of what Raymond Williams called a "structure of feeling"; that is, as an expression of a generation's response to "the unique world it is inheriting, taking up many continuities" yet "feeling its whole life in certain ways differently."[89] Indeed, Bell's feeling of living in

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[85] Hunter Heyck, *Age of System: Understanding the Development of Modern Social Science* (Baltimore: Johns Hopkins University Press, 2015), 156, and Chapter 5: "Modernity and Social Change in American Social Science," 143-158.

[86] On affluence, leisure, knowledge, and white-collar labor, respectively, see Galbraith, *The Affluent Society*; Riesman, "Leisure and Work in Post-Industrial Society"; Fritz Machlup, *The Production and Distribution of Knowledge in the U.S.* (Princeton: Princeton University Press, 1962); C. Wright Mills, *White Collar: The American Middle Classes*, 50th Anniversary (1951; repr., New York: Oxford University Press, 2002).

[87] Bell, *Post-Industrial Society*, 37. On the contours of "postcapitalist" discourse in the 1950s and 60s, see Brick Howard, *Transcending Capitalism: Visions of a New Society in Modern American Thought* (Ithaca: Cornell University Press, 2006), Chapters 5, 6, 7.

[88] Bell, *Post-Industrial Society*, 37.

[89] Raymond Williams, *The Long Revolution* (Cardigan, UK: Parthian, 2011), 69–70.

an interstitial time was shared by a generation of midcentury thinkers across disciplinary, ideological, and political divides, from the techno-futurists of the automation and cybernetics movements to New Left progressives in the United States, May-68 socialists in France, Frankfurt-school critical theorists, and Autonomist Marxists in Italy.

Although change in general was essential to Bell's theory, it was the *rate of change* that struck him as particularly novel, as itself a new chapter in Western modernity. He observed, moreover, that society possessed a new self-consciousness of change in the postindustrial fold: "not only are we aware of, and trying to identify, processes of change," but "the interval between the initial impetus to change and its realization has been radically reduced."[90] Rather than idly watching change follow its course, "post-industrial society" takes the reins; it prunes the dead stems and nurtures the fruits of change, prodding society into progress. Bell's own discernment of the changes characterizing the "post-industrial" turn and the precise moment when it began was itself an expression of not only the new attitude towards change that he described, but of a new attitude toward history. My focus here will be on three particular aspects of change that are equally central to Bell's understanding of "post-industrial society" and my own definition of the "postindustrial paradigm" as an imagined departure from an industrial world defined and determined by the factory system. In order to illustrate this claim, I will probe three key sites of transformations that characterize Bell's rendering of the "post-industrial" era: history, production, and knowledge.

A Break in History

In order to contextualize the social transformations introduced by technology, Bell maps "post-industrial society" onto a tripartite historical schema that relates technological progress to

[90] Bell, "Notes on the Post-Industrial Society (I)," 24–25. For an account of the manifestation of this mindset in a "risk society" created by Cold War policy, see Joseph Masco, *The Theater of Operations: National Security Affect from the Cold War to the War on Terror* (Durham and London: Duke University Press, 2014).

economic development.[91] If the first technological revolution, at the turn of the nineteenth century, was spurred by steam power and the second, at the turn of the twentieth, impelled by electricity and chemistry, the third one, which began around 1945, was—and continues to be—powered by computers and telecommunications.[92] "The concept of a post-industrial society," he notes, "gains meaning by comparing its attributes with those of an industrial society and pre-industrial society."[93] Bell points to the extraordinary extent to which postindustrial society mars a break with the past: "post-industrial society turns its back on both" its forerunners, as much in regards to technology as to "the salient experience of work."[94] Unlike the farmer and the factory operative, postindustrial workers "live more and more outside nature, and less and less with machinery and things; they live with and encounter one another." Life in an agrarian, pre-industrial society, he discerns, is "a game against nature […] structured in traditional ways of routine and authority."[95] Industrial society, on the other hand, is a goods-producing society in which life is "a game against fabricated nature" paced by machines and nestled within a technical and rational world of mass production, organization, and coordination.[96] By contrast, a "post-industrial society" is "a game between persons"—educated, trained, and skilled professionals—based on services and powered by information. And yet, despite these differences, certain characteristics of agrarian and industrial life carry over into the new paradigm, which combines the emphasis on the agrarian human "encounter" and interaction with the game-like character of social coordination in industrial society. But the most significant transformation heralded by postindustrial society was a new quality of life, determined not by goods created and consumed but by "the services and amenities—health, education,

[91] Bell, *Post-Industrial Society*, xxxii.
[92] Ibid., xxxiii–iv.
[93] Ibid., 126.
[94] Ibid., 488.
[95] Ibid., 126.
[96] Ibid., 126–27.

recreation, and the arts—which are now deemed desirable and possible for everyone."[97] Information becomes "a central resource" and a critical "source of power."[98]

As the centrality of intangible resources like information suggests, Bell's distinction between postindustrial and industrial society is as much conceptual as it is material. That is, postindustrial society represents a departure from industrial society not only in technological, social, and economic terms, but also in regards to the theoretical and analytical tools necessary to understand it. "If industrial society," Bell wrote, "is based on machine technology, post-industrial society is shaped by an intellectual technology."[99] Moreover, he continued, "if capital and labor are the major structural features of industrial society, information and knowledge are those of the post-industrial society." As Bell goes on to assert, while production functions and the labor theory of value are apt for an economy that produces material commodities and in which capital is embodied in labor, they are useless tools for understanding an economy based on services, knowledge, immaterial goods, and social products. The "economics of information," Bell insisted, "is not the same character as the 'economics of goods,' and the social relations created by the new networks of information […] are not the older social patterns—or work relations—of industrial society." Thus, "a post-industrial society is characterized not by a labor theory but by a knowledge theory of value."[100]

From Factory Production to the Service Industry

If the shift from manufacturing to knowledge-based services is the pivotal characteristic of Bell's "post-industrial society," the year 1956 is its "symbolic turning point."[101] On this year, "the

[97] Ibid., 127.
[98] Ibid., 128.
[99] Ibid., xcii.
[100] Jürgen Habermas made a similar observation in 1968, noting that, within a "rational society," technology and science "become a leading productive force, rendering inoperative the conditions for Marx's labor theory of value." Jürgen Habermas, *Toward a Rational Society: Student Protest, Science, and Politics*, trans. Jeremy J. Shapiro (1968; repr., Heinemann Educational, 1971), 104.
[101] Bell, "Notes on the Post-Industrial Society (I)," 28.

number of white-collar workers [professional, managerial, office and sales personnel], for the first time in the history of industrial civilization, outnumbered the blue-collar workers [craftsmen, semi-skilled operatives, and laborers] in the occupational structure."[102] Bell linked this transition with the expansion of the service economy that had been predicted by the automation movement. Tracking the dissemination of the service sector into the spheres of "trade, finance, transport, health, recreation, research, education, and government," he observes that it "naturally brought about a shift to white-collar occupations."[103] The growth of health, education, research, and government services, figured as decisive for post-industrial society, also facilitated "the expansion of a new intelligentsia—in the universities, research organizations, professions, and government" that fed the new white-collar market.[104] In this scenario, "the most startling change," on Bell's view, was the surge in professional and technical employment requiring some college education, which grew twice as much as the national average, from 3.9 million in 1940 to 8.6 million by 1964.[105] Meanwhile, the growth rate among scientists and engineers, "who form the key group in the post-industrial society," was, during the same period, triple that of the average workforce.

For Bell, "post-industrial society," even if not yet fully developed, had by then already made strides into transforming both the place and the fundamental character of work. In his 1956 *Work and Its Discontents*, he once again sketched a portrait of the "post-industrial" period by contrasting it with an industrial one. For instance, he claimed that the archetypal and distinctive ethos of the industrial age lay in "the image of tens of thousands of workers streaming from the sprawling factories."[106] And if this image marked "the picture of industrial America," it was not because the

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[102] Bell, *Post-Industrial Society*, 17.
[103] Ibid., 15, 17. In 1967, Bell's definition of the service sector included: "trade; finance, insurance and real estate; personal, professional, business, and repair services; and general government." Bell, "Notes on the Post-Industrial Society (I)," 27.
[104] Bell, *Post-Industrial Society*, 15.
[105] Ibid., 17.
[106] Bell, *Work and Its Discontents*, 3. Quoted in Bell, *Post-Industrial Society*, 162.

majority of the population worked in factories, which was no less true in 1956 than it is today, but rather because "its rhythms, in subtle fashion, affect the general character of work the way a dye suffuses a cloth."[107] While in 1956 Bell commented that the "mechanical and dronelike quality" of office work still served "the same pacing functions as assembly lines," by 1973 he asserted that "post-industrial society" had completely done away with the "distinctive archetype" of the factory.[108] The rhythms of the factory were "no longer that pervasive," and the void left by industrial drudgery became filled by the communicative and affective encounters between individuals that mediate service transactions—"from the irritation of a customer at an airline-ticket office to the sympathetic or harassed response of teacher to student."[109] Whether or not such conversations are "sympathetic" or irritating, "the fact that individuals now talk to other individuals, rather than interact with a machine," Bell concluded, "is the fundamental fact about work in the post-industrial society."

The vacuum following the demise of the factory demanded new theories and class politics corresponding to a world in which factory workers were no longer the agents of human emancipation. Until it could be reworked and "updated," so to speak, by a generation of postwar Marxists, Marx's original vision of the proletariat seemed to Bell to have been warped by the trajectory of industrialization itself, which, to the extent that it tends to replace human labor by machine power, leads "logically to the erosion of the industrial worker himself."[110] In fact, Bell maintained, "the entire area of blue-collar work may have diminished so greatly that the term will lose its sociological meaning as new categories, more appropriate to the divisions of the new labor force, are established." Where Marx had envisioned the dominance of the industrial worker, Bell saw that of the professional and technical class. This renewed character of production and employment

[107] Bell, *Work and Its Discontents*, 36, 3. Quoted in Bell, *Post-Industrial Society*, 162.
[108] Bell, *Post-Industrial Society*, 162.
[109] Ibid., 163.
[110] Ibid., 125.

was a central aspect of Bell's "post-industrial society," one that represented not only a transformation in the formal features of most occupations but a "revolution in the class structure of society."[111] In short, the central inadaptability of Marx's critical theory of capitalism, and any theory that takes labor to be a source of value or understands the economy in terms of material production, is that "the 'labor issue' *qua* labor is no longer central, nor does it have the sociological and cultural weight to polarize all other issues along that axis."[112] By this fact alone, "the changes which are summed up in the post-industrial society may represent a historic metamorphosis in Western society."

The Knowledge Economy

According to Bell, three postwar developments were primarily responsible for the character of postindustrial society: the growth of science and theoretical knowledge, the advancement of intellectual technology, and the expansion of research institutions.[113] At its root, Bell notes, postindustrial society represents the most powerful expression of modernity's quest to replace a natural order with a technical order since the Industrial Revolution.[114] The sense and spirit of postindustrial society—"its areas of conflict, of advance, of engagement"—assume an intellectual character.[115] The fundamental transformation that defines postindustrial society inheres in "some specifically defining characteristic of a social system, which becomes the axial principle, that one establishes a conceptual schema."[116] And if the nerves of this new system are lodged in its defining

[111] Ibid., 125–26.
[112] Ibid., 164.
[113] Bell, "The Post-Industrial Society," 44. For an overview of postindustrial theories of the knowledge economy, see Steven Brint, "Professionals and the 'Knowledge Economy': Rethinking the Theory of Postindustrial Society," *Current Sociology* 49, no. 4 (July 2001): 101–32.
[114] Bell, *Post-Industrial Society*, 45.
[115] Bell, "The Post-Industrial Society," 44.
[116] Bell, *Post-Industrial Society*, 18–20.

characteristics, then "the ganglion of the post-industrial society is knowledge."[117] While "the axial principle" of industrial society was the "coordination of machines and men for the production of goods," in a postindustrial society it is the organization of knowledge used "for the purpose of social control and the directing of innovation and change" that, in turn, "gives rise to new social relationships and new structures which have to be managed politically."[118] And while knowledge has been, in some form, a crucial characteristic of all modern societies, what is distinctive about postindustrial society is not simply the role of knowledge as a new source of power and capital, but "the change in the character of knowledge itself."[119] Here, a new type of knowledge emerges and takes center stage—"theoretical knowledge," the efficacy and importance of which lies in "the primacy of theory over empiricism, and the codification of knowledge into abstract systems of symbols that can be translated into many different and varied circumstances."[120] Due to its versatile applicability and rigor, theoretical knowledge becomes the most essential resource for organizing decisions and controlling the direction of change; it is the matrix of innovation and growth in all realms of postindustrial society.[121]

But in order for theoretical knowledge to be spread throughout society it needs to be applied or embodied in technology and, moreover, it needs a home where it can be cultivated, learned, taught, and developed. The first of these requirements is solved by a new type of technology, which Bell calls "intellectual technology." What renders this technology "intellectual," according to Bell is the "substitution of algorithms (problem-solving rules) for intuitive judgments." These algorithms, he continues, "may be embodied in an automatic machine or a computer program or a set of

[117] Bell, "Notes on the Post-Industrial Society (I)," 28.
[118] Bell, *Post-Industrial Society*, 20.
[119] Ibid., 20, 343.
[120] Ibid., 343–44.
[121] Bell, "Notes on the Post-Industrial Society (I)," 20, 29.

instructions based on some statistical or mathematical formula."[122] In this way, complex problems can be dealt with by formalizing a set of decision rules through statistical and logical techniques.[123] As predicted by some in the *Fortune* 1953 roundtable, human judgements were being supplanted by computation. For on Bell's account multivariate analyses, simultaneous calculations, and comprehensive numeracy in general "are possible only with a tool of intellectual *technology*, the computer." From the perspective of the automated mind, in all situations where a choice must be made amidst constraints, alternatives, risks, and uncertainty, "the desirable action is a strategy that leads to the optimal or 'best' solution; i.e. one which either maximizes the outcome or, depending upon the assessment of the risks and uncertainties, tries to minimize the losses."[124] Technology thus takes on the role of judging and reasoning, of determining the optimal course of action; all humans are left to do is act upon the machine's assessment.

To the extent that theoretical knowledge becomes "the axial principle" of postindustrial society and intellectual knowledge its foundation, old institutions, suited only for obsolete knowledge and technology, give way to new establishments where the emerging types of knowledge and technology can proliferate and flourish. Those establishments where theoretical knowledge is codified and enriched—universities, research organizations, intellectual institutions—become the new "axial structures of the emergent society."[125] The university in particular serves as the "primary institution of the new society" because it is able to create, codify, and test theoretical knowledge in "a disinterested way."[126] Just as the image of factory work was replaced by the encounter and communication of individuals, the business enterprise loses its predominance over society and is replaced by the new major institutions of society: "a vast new array of conglomerations of

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[122] Bell, *Post-Industrial Society*, 29–30.
[123] Ibid., 30.
[124] Ibid., 30–31.
[125] Ibid., 26.
[126] Bell, "Notes on the Post-Industrial Society (I)," 30.

universities, research institutes, research corporations."[127] This shift from the corporation to the university is expressed in all its force today by Google's "knowledge campus." Turning to the spaces of intellectual production that came to structure and be structured by the new knowledge economy, I will now examine critical theories of the "interstitial" moments in which they were conceived. In the next section, I track significant theoretical accounts and penetrating critiques of capitalism that register the alleged displacement of real factories and material labor by "social factories" and "immaterial labor," of industrial capitalism by "cognitive" capitalism.

PART 3: CRITICAL THEORIES OF CAPITALIST SOCIETY

As liberal social scientists fanned the flames of a looming postindustrial future, critics of capitalism began to reflect on what was indeed new about postwar capitalism and whether the Marxist tradition they had inherited remained a useful resource for understanding and confronting whatever it was they were suddenly up against.[128] This emergence of a critical theory of postindustrial capitalism was an undeniable corollary of the cataclysmic transformations that followed World War II. It was a response to the productive and cultural rearrangements of capitalist societies influenced as much by the rise of automated electronic technologies as by the surge in financial speculation, the ubiquity of mass broadcast media, and the widespread political and social upheaval impelled by the breakdown of Bretton Woods and later accelerated by decades of sustained neoliberal reforms. In the 1960s, when these transformations began to seep into the public imaginary with unprecedented force, a host of critical thinkers turned their attention to postindustrial capitalism from a variety of perspectives that drew on Marx and currents of Marxist thought through a series of creative re-readings and re-imaginings. So, while the socioeconomic

[127] Bell, "The Post-Industrial Society," 44.
[128] One early publication to announce this shift was the *Monthly Review*'s special issue on "New Capitalism" in 1959. See Paul M. Sweezy, "Theories of the New Capitalism," *Monthly Review* 11, no. 3 (August 1959): 65-75.

developments of the postwar period heralded a new era in the global economy, they also marked a decisive turning point in critical theories of capitalism. Although Marxists agreed with Bell that the composition of the working class and the character of work had been radically transformed by technological innovations and economic growth, they insisted that these changes would not, in and of themselves, abolish capitalist exploitation. They believed that only a broader and renewed understanding of class, labor, and the workplace stood a chance to confront the novel, all-embracing character of capitalist domination across a vast array of interconnected social relations that transcended factories and industrial production. Above all, this reinvigorated critique of capitalism held a promise which a rising generation of critical thinkers felt orthodox Marxism had been unable to deliver: to contend with the sweeping changes of a new capitalist society that was yet unnamed and undefined. And here again, the foretold death of the factory system became a pivotal object of inquiry.

In one of the more biting slights to bourgeois consciousness in *Capital*, Marx ridicules enthusiasts of the factory system for having "nothing more damning to urge against a general organization of labour in society than that it would turn the whole of society into a factory."[129] In the eyes of twentieth-century critics, however, the damning cry of factory apologists had become a reality. Early in the century, for instance, Max Weber and György Lukács responded to the dominant transitions in the capitalist economy of their day by offering new directions for understanding the function of the factory system beyond the immediate sphere of production. For Weber, the separation of workers from the means of production was the product of an "inescapable universal bureaucratization" strewn across the whole of society.[130] From a social-scientific

[129] Karl Marx, *Capital: A Critique of Political Economy*, trans. Ben Fowkes, vol. 1 (1867; repr., London: Penguin Books, 1990), 477.
[130] Max Weber, "Socialism (1918)," in *Weber: Political Writings*, ed. Peter Lassman and Ronald Speirs (1994; repr., Cambridge: Cambridge University Press, 2003), 279.

standpoint, he wrote, "the modern state is an 'organisation' (*Betrieb*) in exactly the same way as a factory; indeed this is its specific historical characteristic."[131] Echoing Weber's reflections, Lukács noted that the factory was not only the medium through which "the fate of the worker becomes the fate of society as a whole," but that its organization of production "contained in concentrated form the whole structure of capitalist society."[132] In other words, the association of factory and society flows in both directions: the factory contains the whole of society while society itself becomes a factory. In the same way that the lived reality of a factory worker was determined by the pecuniary imperatives of capital, so too did bureaucracy rearrange life, work, and consciousness according to, as Lukács put it, the "general socio-economic premises of the capitalist economy."[133] That is, the rational fragmentation, scientific specialization, and mechanical standardization that condition the lives of workers inside the factory also govern all aspects of their lives outside it. Well before the emergence of a "postindustrial" era, this entanglement of the factory and society was already said to become more salient as the character of work became more skilled, informational, and cultural.

Throughout the 1950s, C. Wright Mills was among the first social theorists on the American left to think extensively about the ways in which technological, economic, and cultural developments in industrialized societies had radically altered the composition of the working class and the character of work.[134] While Mills wrote at length about an emerging class of white-collar professionals, there was far more to his thought than the transition from the factory to the office. The grounds for a new analysis of capitalism were, on his telling, laid open most decisively by a rising class of cultural workers. His suggestion was to dislocate critical theories of capitalist society

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[131] Max Weber, "Parliament and Government in Germany under a New Political Order (1918)," in *Weber: Political Writings*, ed. Peter Lassman and Ronald Speirs (1994; repr., Cambridge: Cambridge University Press, 2003), 146.
[132] György Lukács, *History and Class Consciousness: Studies in Marxist Dialectics*, trans. Rodney Livingstone (1923; repr., Cambridge: MIT Press, 1971), 90, 91.
[133] Ibid., 98.
[134] Mills, *White Collar*.

from their industrial footing in the factory and anchor them instead in what he called the "cultural apparatus," whose workers—mostly intellectuals and artists—were a "possible, immediate, radical agency of change."[135] For Mills, the cultural apparatus designated a hybrid sphere of production, distribution, and consumption composed of "all the organizations and *milieux* in which artistic, intellectual and scientific work goes on, and of the means by which such work is made available to circles, publics, and masses."[136] Its labor process inhered in the production, exchange, distribution, and circulation of art, science, learning, information, and entertainment organized across an elaborate ensemble of institutions in which factories had no place: "schools and theaters, newspapers and census bureaus, studios, laboratories, museums, little magazines, radio networks." Yet, inside this apparatus, cultural workers were losing control over the means of production while the condition of intellectual work and the distribution of its products were becoming "increasingly bureaucratic."[137] This was in large part because, within capitalist societies, "all that has happened to work in general—in a word, alienation—is now rapidly happening to cultural, scientific, and artistic endeavors."[138] The overall consequence of these changes, Mills had it, was nothing short of a watershed in the history of capitalism, placing the industrialized world at the brink of a "post-modern period," or "The Fourth Epoch."[139] In this context, Mills defined an advanced capitalist society such as the United States as an "Overdeveloped Society" in which "the economic emphasis moves from production to merchandizing," from the factory to the "great sales-room."[140] In the postwar era, he continued, "the new economy has flowered like a noxious weed" and "the

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[135] C. Wright Mills, "Letter to the New Left," *New Left Review*, no. 5 (October 1960): 22.
[136] C. Wright Mills, "The Cultural Apparatus (1959)," in *Power, Politics and People: The Collected Essays of C. Wright Mills*, ed. Irving Louis Horowitz (New York: Oxford University Press, 1963), 406.
[137] C. Wright Mills, "The Decline of the Left (1959)," in *Power, Politics and People: The Collected Essays of C. Wright Mills*, ed. Irving Louis Horowitz (New York: Oxford University Press, 1963), 266.
[138] Ibid; Mills, "The Cultural Apparatus (1959)," 418.
[139] Mills, "Culture and Politics (1959)," 236.
[140] C. Wright Mills, "The Structure of Power in American Society (1958)," in *Power, Politics and People: The Collected Essays of C. Wright Mills*, ed. Irving Louis Horowitz (New York: Oxford University Press, 1963), 240.

distributor becomes ascendant over both the consumer and the producer."[141] These developments at once set the stage for an original critique of capitalist society rooted in the discovery and analysis of a new working-class subject, new spheres of work, and new forms of cultural and intellectual labor. At the same time, Mills's juxtaposition of industrial society with the cultural apparatus, the factory with the sales-room, production with merchandizing, reveals the limits of his historical understanding of what industrial societies and factories actually were. As I argue in the following chapters, factories fundamentally shaped culture, art, and aesthetics since their inception in the long eighteenth century and, in their earliest instantiation as overseas trading outposts, factories had more in common with Amazon's warehouses than with Ford's assembly lines. If nothing else, factories have always been and continue to be "great sales-room."

Broadly, the turn to culture suggested by Mills in the 1950s and 60s was of a piece with earlier approaches to thinking about capitalism's cultural politics that, according to Michael Denning, can be "summed up in the phrase 'the cultural front.'" [142] And after the Second World War, this intellectual frenzy over mass culture was, in Denning's words, "an engine of what those intoxicated by the new discovery called a 'postindustrial' society."[143] It was against this background, in the midst of "postindustrial" society steeped in automation and affluence, that Herbert Marcuse, for instance, developed the ideas at the core of *One-Dimensional Man* (1964). His perception of the factory's imminent displacement by automation suggested that industrial society was entering a new phase. Technology, he argued, had become a conduit for fusing cultural aspects of modern society—leisure, amusement, contentment, fulfillment—with the workplace itself; the private space in which "man may become and remain 'himself'" had been "invaded and whittled down by technological

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[141] C. Wright Mills, "Man in the Middle: The Designer (1958)," in *Power, Politics and People: The Collected Essays of C. Wright Mills*, ed. Irving Louis Horowitz (New York: Oxford University Press, 1963), 378.
[142] Michael Denning, *The Cultural Front: The Laboring of American Culture in the Twentieth Century* (London and New York: Verso, 1997), xix, 38-39, 96-103.
[143] Michael Denning, *Culture in the Age of Three Worlds* (London and New York: Verso, 2004), 1.

reality."[144] As a result, Marcuse concluded, "mass production and mass distribution claim the *entire* individual, and industrial psychology has long since ceased to be confined to the factory." Within a similar context, and in response to the prodigious levels of economic growth and scientific innovations in the industrialized West, Theodor Adorno questioned the reigning assumption among social scientists "that Marx is out of date."[145] While conceding that workers were more immersed in bourgeois culture than ever before, he argued strongly that recent developments in technology, affluence, and social relations neither warranted a renunciation of capitalism as an analytic category nor indicated that the working class had ceased to exist as such. Critical theory, he proposed, must take on the task of demystifying the contradictions and changes of late capitalism that social scientists had failed to grasp through quantitative methods. And given the totalizing character of these transformations, a critical project to rethink domination and freedom within a new capitalist society could not be limited to the factory any longer.

One influential path toward such a critical theory of postindustrial capitalism began to take shape in Italy. Here, from the 1960s to the 1980s, a group of intellectuals, workers, and activists set out to redraft the terms of the factory's relationship to a capitalist society in rapid transition. This current of radical thought and practice, known as *operaismo*, was originally conceived in the early 1960s by a dissident faction of Italian Marxists that included Mario Tronti, Antonio Negri, and Mariarosa Dalla Costa, among others. The movement—segments of which would eventually lead to "Autonomist" Marxism—centered on the shared commitment of its members to confront Marxist theory with "the *real* study of a *real* factory."[146] This fresh reencounter with Marx involved above all a

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[144] Ibid., 12.
[145] Theodor W. Adorno, "Late Capitalism or Industrial Society?: The Fundamental Question of the Present Structure of Society," in *Can One Live After Auschwitz?: A Philosophical Reader*, ed. Rolf Tiedemann, trans. Rodney Livingstone (1968; repr., Stanford: Stanford University Press, 2003), 111.
[146] Steve Wright, *Storming Heaven: Class Composition and Struggle in Italian Autonomist Marxism*, 2nd ed. (2002; repr., London: Pluto, 2017), 3.

disavowal of abstract ideas in an attempt to, as Tronti recalls, "unite the thinking and practice of politics in a determinate domain, that of the modern factory."[147] The result was a set of influential reflections on what the factory meant to critical thought, the labor movement, and late capitalism.[148] Much like earlier revisions of orthodox Marxism by Weber, Lukács, Mills, Marcuse, and Adorno, Tronti believed that the social relations of production in an advanced phase of capitalist development took on both the industrial character of factory work and the political character of labor's struggle against capital while, by the same token, the socialization of labor intensified and the relations of production within the factory acquired a categorically social character.[149] "When the whole of society is reduced to a factory," he wrote in an emblematic phrase, "the factory—as such—appears to disappear."[150] And as the rift between the factory and society caved, an all-encompassing "social factory" formed in its wake. Yet, because Tronti's definition of the "social factory" remained bound by manufacturing and manual labor, it did not broaden the critique of capitalist social relations beyond direct production and industrial capitalism as some of his contemporaries would have liked.[151] It was only in the hands of Autonomist thinkers and Negri in particular that the "social factory" became synonymous with the alleged demise of the "real factory" in postindustrial society and Marxist thought alike.

Throughout the 1970s, Negri challenged the dominant view that factories and proletarians were the epicenter of class struggle in favor of an alternative, expansive account of capitalist social relations untethered by factories, industrial workers, and the material production of commodities.[152]

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[147] Mario Tronti, "Workerism and Politics," *Historical Materialism* 18 (2010): 186.
[148] Wright, *Storming Heaven*, 30.
[149] Mario Tronti, *Operai e Capitalo*, Nuova edizione accresciuta (1962; repr., Turin: Giulio Einaudi, 1971).
[150] Ibid., 52.
[151] Wright, *Storming Heaven*, 37.
[152] Antonio Negri, "Crisis of the Planner-State: Communism and Revolutionary Organisation (1971)," in *Revolution Retrieved: Writings on Marx, Keynes, Capitalist Crisis and New Social Subjects (1967-83)*, by Antonio Negri (London: Red Notes, 1988), 91–148; Antonio Negri, *Proletari e Stato: Per Una Discussione Su Autonomia Operaia e*

Through an original reading of Marx's *Grundrisse*, Negri revised some of the most fundamental categories of Marxist political economy, from the labor process to the wage form.[153] Henceforth, the foregoing associations between the "social factory" and the real factory waned and withered.[154] As he put it in 1980, "capitalist society has become—really, not by analogy—a 'social factory.'"[155] The "walls of the 'factory' fell down long ago," he wrote in 1989, and "because it encourages one to think only in terms of material products, the term 'factory' should be abandoned."[156] Departing from the widely-held view that the factory had been liquidated from the physical realm of postindustrial societies, Negri played a key role in excising it from an emerging current of Marxist theory.[157] But as many critics pointed out at the time, Autonomists offered very little evidence that their ideas conformed or spoke to the realities of economic life, much less that the factory had indeed become a bygone site of production, value, and domination.[158] Although its walls were as solid as ever to those inside, the factory became an increasingly irrelevant object of inquiry to a host of critical thinkers attempting to understand postindustrial capitalism.

To be sure, the Autonomist departure from the established schema of orthodox Marxism was a promising development. One of its most fruitful prospects was indeed to broaden the ambit of work, workers, and the workplace to include productive activities, people, and spaces traditionally excluded from critiques of political economy, including housework, informal labor, the domestic sphere, undocumented migrants, women, and workers of color. This was in fact how some feminist

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Compromesso Storico, 2nd ed. (Milan: Feltrinelli, 1976). On the context of Negri's rupture with workerists, see Wright, *Storming Heaven*, 86–92, 127, 150-1.

[153] Wright, *Storming Heaven*, 152–53.

[154] On the history of the social factory, see David P. Palazzo, "The 'Social Factory' in Postwar Italian Radical Thought from Operaismo to Autonomia" (Ph.D. Dissertation, City University of New York, 2014).

[155] Antonio Negri, "Interview with Tony Negri (1980)," in *Revolution Retrieved: Writings on Marx, Keynes, Capitalist Crisis and New Social Subjects (1967-83)* (London: Red Notes, 1988), 245–52.

[156] Antonio Negri, *The Politics of Subversion: A Manifesto for the Twenty-First Century*, trans. James Newell (Cambridge: Polity, 1989), 215.

[157] For a recent illustration, see Rosalind Gill and Andy Pratt, "In the Social Factory? Immaterial Labour, Precariousness and Cultural Work," *Theory, Culture & Society* 25, no. 7–8 (2008): 1-30.

[158] Wright, *Storming Heaven*, 151, 157–59, 208.

thinkers, such as Silvia Federici and Mariarosa Dalla Costa, understood the radical potential of breaking with standard accounts of capitalism centered on large factories, wage-labor, and a predominantly white male proletarian culture.[159] Yet, Autonomist ideas about postindustrial capitalism were especially influential among a group of theorists who persisted in shrouding marginalized realities of economic life under new abstractions like the "general intellect" and "cognitive capitalism."[160]

The widespread uptake of Autonomist thought in the late 1990s and early 2000s, especially by Anglo-American social and political theorists, coincided with the escalation of offshore outsourcing, venture capital, and the internet.[161] By the turn of the twenty-first century, a new wave of Autonomist-inspired theories had emerged, offering a politically optimistic view of "cognitive capitalism" as an unmitigated departure from its Fordist forerunner.[162] This approach also inaugurated a conceptual grammar fit for describing and critiquing a "post-Fordist" economy irrevocably removed from factories, manufacturing, and manual labor.[163] Its focus was on the ascent of immaterial labor as the most economically relevant, politically significant, and theoretically useful form of production in the global economy—"hegemonic over all the other valorization processes."[164] In this sense, Autonomist theories of cognitive capitalism can be seen as a

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[159] See Silvia Federici, "Wages Against Housework (1975)," in *Revolution at Point Zero: Housework, Reproduction, and Feminist Struggle*, by Silvia Federici (Oakland: PM, 2012), 15–22; Mariarosa Dalla Costa and Selma James, *The Power of Women and the Subversion of the Community*, 3rd ed. (1972; repr., Bristol: Falling Wall, 1975).
[160] On "cognitive capitalism," see Carlo Vercellone, "From Formal Subsumption to General Intellect: Elements for a Marxist Reading of the Thesis of Cognitive Capitalism," *Historical Materialism* 15 (2007): 13–36.
[161] See Paolo Virno and Michael Hardt, eds., *Radical Thought in Italy: A Potential Politics* (Minneapolis: University of Minnesota Press, 1996).
[162] This was largely influenced by Michael Hardt and Antonio Negri's co-authored books *Empire* (2000) and *Multitude* (2004). For a genealogy of "cognitive capitalism," see Caffentzis, "A Critique of Cognitive Capitalism," in *In Letters of Blood and Fire: Work, Machines, and the Crisis of Capitalism* (Oakland: PM, 2013), 95-123.
[163] See Michael Hardt, "Immaterial Labor and Artistic Production," *Rethinking Marxism: A Journal of Economics, Culture & Society* 17, no. 2 (2006): 175–77; Michael Hardt, "Affective Labor," *Boundary 2* 26, no. 2 (1999): 89–100; Maurizio Lazzarato, "Immaterial Labor," in *Radical Thought in Italy*, 133–47.
[164] Michael Hardt and Antonio Negri, *Commonwealth* (Cambridge: Belknap, 2009), 25.

continuation and critical adaptation of what midcentury liberal social scientists dubbed "post-industrial society." Today, the conceit that immaterial labor is the predominant input of high-tech production remains a basic axiom of contemporary critiques of capitalism. The prodigious number of recent studies on "digital labor" and "post-capitalism" are particularly illustrative of the wide-ranging purchase of cognitive capitalism in critical theory, especially among scholars working on the transformations of capitalist societies propelled by emerging technologies.[165]

For adherents of this approach, the interplay between financialization, economic growth, technological innovation, and the widespread diffusion of and access to education, information, and knowledge has culminated in the following postindustrial developments: first, the ascendancy of immaterial labor as a biopolitical transformation of capitalist production characterized by linguistic, affective, intellectual, and cultural work, the end result of which is the production of subjectivities and information rather than material commodities; second, the proliferation of a dispersed and common pool of knowledge, skills, and capabilities purveyed by the internet and open-source software known as the general intellect; third, a shift in the planning of production away from capitalist centralization and toward the autonomous organization and social cooperation of workers; and finally, the return of indirect forms of extraction, known as "formal subsumption," through which capital is said to capture value from labor at a distance, without having to control production or discipline workers directly. Together, these circumstances are credited with setting the stage for a new kind of worker-based resistance against capitalism—what Hardt and Negri call "elementary communism."[166]

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[165] See Jodi Dean, "Communicative Capitalism and Class Struggle," *Spheres* 1 (2014): 1–16; Trebor Scholz, ed., *Digital Labor: The Internet as Playground and Factory* (New York: Routledge, 2013); Paul Mason, *Postcapitalism: A Guide to Our Future* (New York: Ferrar, Straus, and Giroux, 2015); Nick Srnicek and Alex Williams, *Inventing the Future: Postcapitalism and a World Without Work* (London: Verso, 2015).
[166] Hardt and Negri, *Commonwealth*, 294.

Contrary to what some of their critics have suggested, Autonomists do not claim that the factory and manufacturing have become irrelevant or obsolete *tout court*, but only within immaterial spheres of production.[167] That is, the displacement of the factory by immaterial labor, they tell us, applies only to the knowledge-based services and information technology. At the same time, most critical theorists of postindustrial capitalism who assent to this position tend to overstate the impact of technology and automation on the contemporary labor process while neglecting the recent, sizeable growth of giant factories in the high-tech sector.[168] Not only are factories larger and more pervasive today than they have ever been, but industrial manufacturing is an essential node in the supply chains of the world's most coveted consumer electronics.[169] Be that as it may, the argument I pursue in the following chapter is that even *within* the production of immaterial, informational, and digital commodities, such as data, texts, codes, sounds, and images, the factory remains as relevant and dominant as it was to Ford's mass production of Model Ts—and as it still remains to Foxconn's iPhone assembly lines. In short, the postindustrial paradigm, in all of its iterations, has given a remarkably short shrift to the reproduction of menial and disciplined work that crucially holds up the society it imagined and projected. As we come to grips with the "postindustrial" social relations of production inside data centers and microwork platforms in the following chapter, we will find ourselves in the midst of a labor process at once thoroughly anchored in and utterly dependent on the factory's political regimes of production, discipline, surveillance, and control.

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[167] See David Neilson, "Formal and Real Subordination and the Contemporary Proletariat: Re-coupling Marxist Class Theory and Labour-Process Analysis," in *Capital & Class* 91 (2007): 89-123; Paul Thompson, "Foundation and Empire: A Critique of Hardt and Negri," in *Capital & Class* 86 (2005): 73-98.
[168] For Hardt and Negri's latest statements on automation and high technology, see Michael Hardt and Antonio Negri, *Assembly* (Oxford: Oxford University Press, 2017), 28, 111-12, 147, 175, 188. On the recent growth of industrial factories in South and East Asia, see Freeman, *Behemoth: A History of the Factory and the Making of the Modern World* (New York: W. W. Norton & Company, 2018). On the overstated impact of automation on employment, see David H. Autor, "Why Are There Still So Many Jobs? The History and Future of Workplace Automation," *The Journal of Economic Perspectives* 29, no. 3 (2015): 3–30; Aaron Benanav, *Automation and the Future of Work* (London and New York: Verso, 2020).
[169] On the rise of electronics factories in China, see Boy Lüthje et al., *From Silicon Valley to Shenzhen: Global Production and Work in the IT Industry* (Lanham: Rowman & Littlefield, 2013).