JACOBIN

ISSUE 17

SPRING 2015

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CLEAN
iRobot
Roomba

In 1934, Sutnar repeated his feat at the 3rd Workers' Olympiad, collaborating again with the creator of the theme, Karel Loersch, and director Vojta Novák. The script on "liberated labor," inspired by hopes for a socialist future, was influenced by the Great Depression of the 1930's. The design is striking — darkly dressed masses of "workers," masses of "engineers" in white and an iron army of robots reel around the key symbol of mechanized industry: a huge press. When economic depression causes workers to lose their jobs, they turn to the machines attacking them as enemies. The capitalists flee from the factories and the press then addresses the rebelling masses, telling them in a human voice that it is a laborer, just like them. A new era opens, with machines and people joined in labor for the good of the whole society.

Ladislav Sutnar, Design in Action

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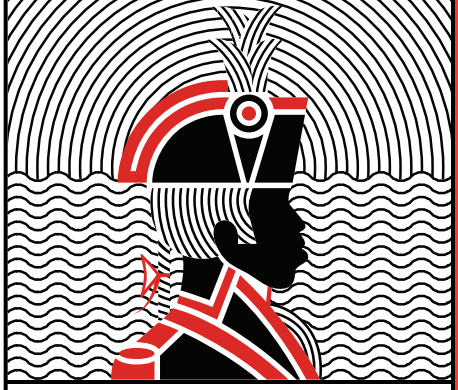

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Subscription Price:
$29 US (print), $39 Canada (print), $59 international (print), $19 (digital)

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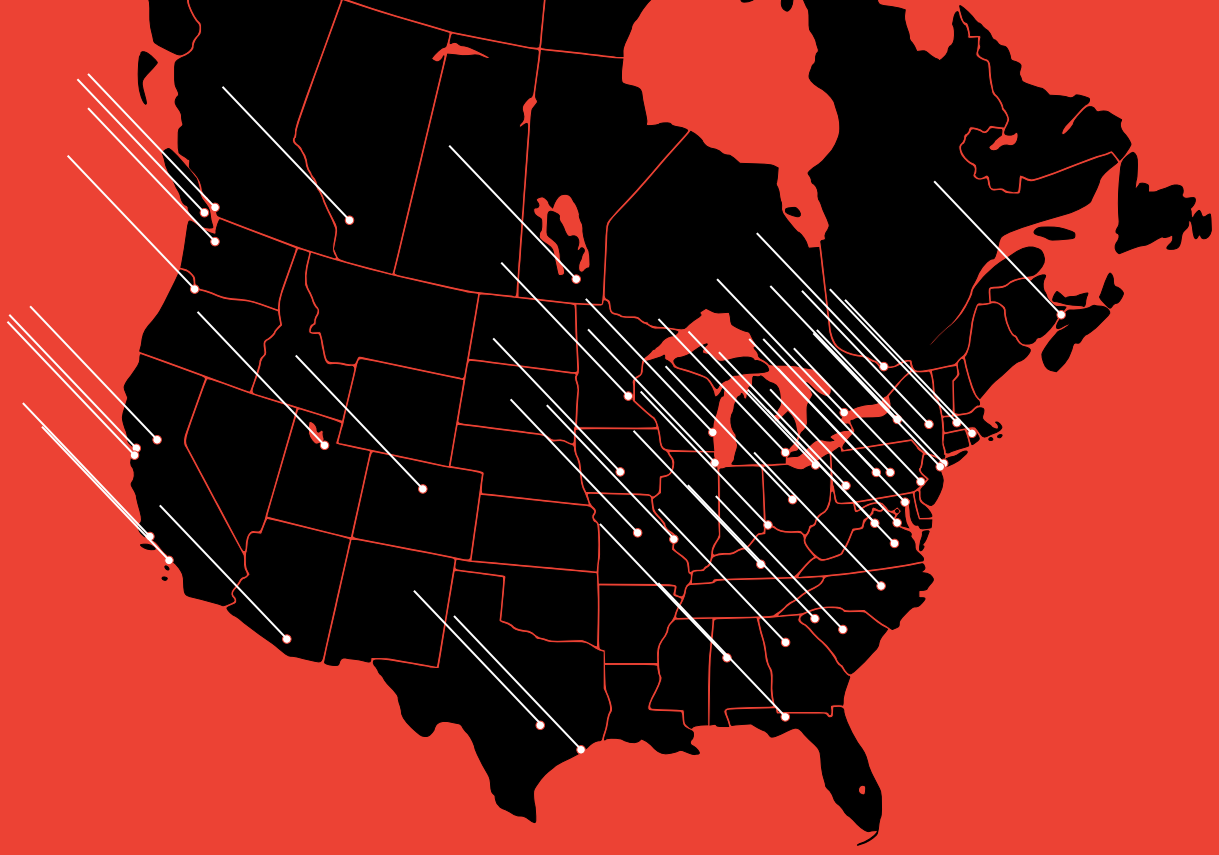

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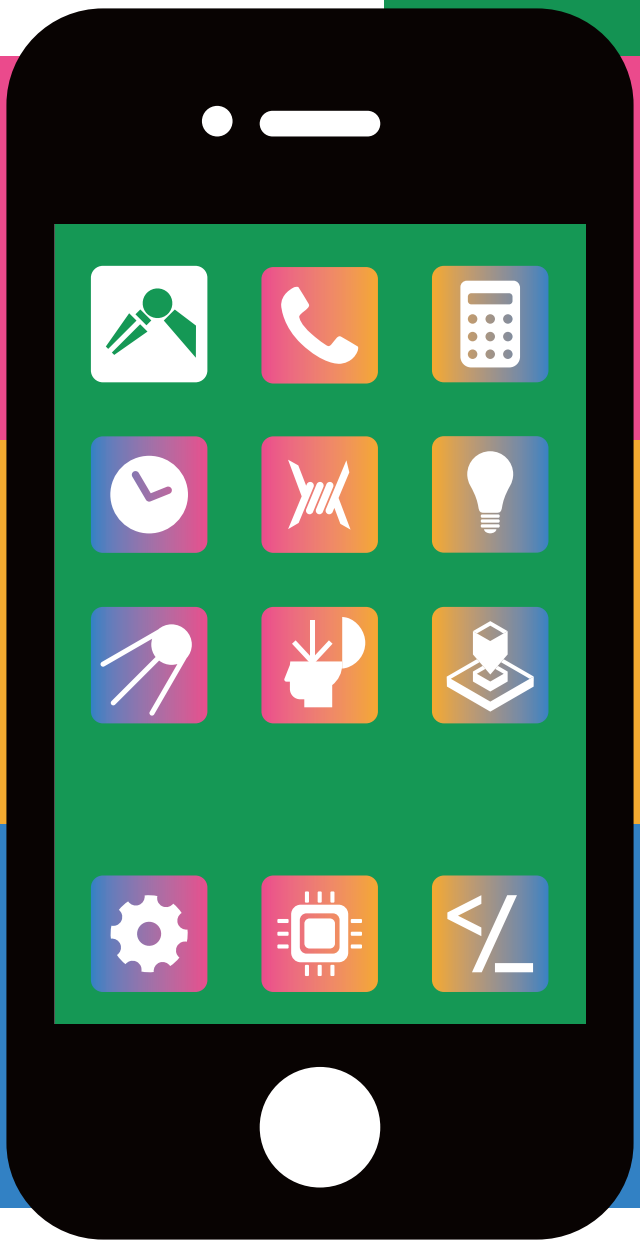


Ours to Master

Is Google making us stupid? Is Facebook making us lonely? Are robots going to steal our jobs? These, it seems, are the anxieties that afflict many today.

Capitalism is defined by the drive to maximize profits, and one of the surest paths to that goal has always been reducing the cost of wage labor. Hence, the constant push to increase productivity through new production techniques, automation, and now computerization and robotization.

Anxiety about the effects of capitalist technology on labor is as old as industrial capitalism itself. In folklore, one of the most famous representations of this unease is the legend of John Henry, a railroad worker who died trying to keep up with the prowess of the steam-powered hammer.

But now, worries about the obsolescence of the worker have reached a fever pitch. The confluence of wage stagnation, a jobless economic recovery, and rapid improvements in automation and artificial intelligence have stoked the fear of mass unemployment that has always haunted discussions of technology.

Widely circulated studies project that up to 80 percent of current jobs are susceptible to automation in the near future. Some of this is hyperbole, but it is clear that automation is moving out of the factory and into the realm of intellectuals and writers — the very people responsible for producing much of the literature of techno-skepticism. (Hence the timid plea of *Mother Jones* writer Kevin Drum: "Welcome, Robot Overlords. Please Don't Fire Us?")

The socialist movement, and Marxism in particular, has a complicated relationship with the tools of capitalist production. Our challenge is to see in capitalism's

technical development both the present-day instruments of employer control and the preconditions for a future post-scarcity society.

The mainstream discourse tends toward the facile view that technology is a thing that one can be for or against; perhaps something that can be used in an ethical or unethical way. But technology in the labor process, just like capital, is not a thing but a social relation. Technologies are developed and introduced in the context of the battle between capital and labor, and they encode the victories, losses, and compromises of those struggles. When the terms of debate shift from the relations of production to a reified "technology," it is to the benefit of the bosses.

Take, for example, the 2013 strike of San Francisco's transportation workers. The San Francisco BART trains serve many of the Silicon Valley elites, who vented their frustration at being inconvenienced by a labor action. In the process, they attempted to frame the strike as an argument about the merits of technology: the workers were supposedly resisting the introduction of time- and labor-saving technologies in the transit system.

The union, however, saw things differently. The workplace rules they were attempting to preserve were largely unrelated to implementing new technologies, and had to do mostly with things like "preventing BART management from making punitive work assignments to employees who have filed workplace complaints."

The question, then, becomes how to incorporate technology into social thought and political strategy without treating it as external to social relations or falling into the crude techno-utopian versus techno-skeptic dichotomy, all the while recognizing that the technical mediations of labor and capital do have some relatively autonomous existence. Sometimes political struggles turn on the use of certain technologies, but they are never just about those technologies; they are ultimately about the balance of class power. What's needed might be called "enlightened Luddism," if that term can indeed be reclaimed.

The Luddites were nineteenth-century English artisans known for smashing labor-saving machinery. Today, their name symbolizes either heroic resistance against repressive machines, or intransigent hatred of all technological progress. It's no surprise that the Information Technology and Innovation Foundation, a think tank funded by the likes of Google and IBM, bestows its Luddite Awards on those it deems insufficiently pro-technology. Yet the recipients are often more interested in advancing egalitarian social policy than in derailing technology; the report on the 2014 awards denounces hotel regulation and dismisses concerns about privacy in health records.

The original Luddites are similarly misunderstood. As Marxist historian Eric Hobsbawm wrote in a 1952 article, machine breaking was a common tactic of labor resistance during the Industrial Revolution. Rather than directing their anger at technology per se, workers broke machines "as a means of coercing their employers into granting them concessions with regard to wages and other matters." Such sabotage

"was directed not only against machines, but also against raw material, finished goods, and even the private property of employers."

The modern figure of the Luddite is valuable to capitalists and their ideologues for primarily rhetorical reasons: if workers can be portrayed as hostile to some method or device that has manifestly positive qualities, they can be dismissed as selfish or irrational. Never mind that in many cases, the problem is that useful and potentially emancipatory technologies are trapped within a capitalist integument, optimized to maximize private profit rather than social wealth.

That's not to say the arguments of the tech titans aren't logical on their own terms. From the standpoint of capital, there is little difference between machine sabotage and other kinds of labor action. For the owner of the machines, after all, their value is not in the specific thing they produce, but in how much money they return. A machine is just part of the greatest capitalist production process of all: M-C-M′, the method of turning money into more money by passing it through a process of hiring, producing, and selling.

As soon as a machine is bought, it costs its owner money: loans must be paid back, physical plants begin deteriorating, and new machines constantly threaten to make existing ones competitively unusable. Thus anything that slows down or stops production has the effect of destroying some of the value of the machine as capital, which to the capitalist is its real substance. Whether it is a sit-down strike or a monkey wrench that stops production is immaterial, since in both cases value is destroyed. For owners, all worker resistance is Luddism.

Hostility to new technologies, the suspicious regard of all "innovation" as a capitalist plot, has a logic for labor, albeit a shortsighted one. The Luddites are often invoked as a talisman against all criticism of technology, a warning that it is impossible to resist the inevitable march of progress. This mystifies the politics of progress by draining it of its conflict and political stakes. But if worker resistance amounts to no more than standing athwart technical change shouting "Stop!" it can only preserve a thoroughly capitalist status quo.

Anti-technology leftism casts workers as intransigent conservatives, clinging to existing technologies that — if the crisis of industrial labor in the full-employment days of the 1960s and 1970s is any indication — are not particularly beloved. The industrial manufacturing that some now want to preserve was once considered a monstrous imposition on the prerogatives of craft labor. Moreover, resistance to technology encourages fragmentation, pitting workers against consumers, who appreciate access to the social wealth made possible by capitalist development.

An alternative strategy to resisting today's technology is to address questions of class power and distribution. Some of the first socialists in the United States to directly confront this dynamic were communist autoworkers in Detroit, grappling with the impact of robotization. Nelson Peery, a radical autoworker in the

League of Revolutionary Black Workers, saw automation as a process that would render older forms of industrial organization irrelevant and herald a new stage of class struggle.

Of course, most autoworkers ended up with neither high-wage jobs nor a rising share in social wealth, as industry restructuring and de-unionization proceeded alongside the dismantling of the Keynesian welfare state.

So what would it mean to fight for social rights in a framework that moves beyond industrial nostalgia? The case of the West Coast longshoremen's union provides an illustrative example, both for its possibilities and for its limits. Confronted with the automation and containerization of ports and the concomitant collapse in demand for labor starting in the 1960s, the port union struck a deal. As *New York Times* labor reporter Steven Greenhouse recounted: "Management promised all longshoremen a guaranteed level of pay, even if there was not work for everyone." The actual terms of the deal and the context in which it was struck were far from ideal, but demands like these highlight the need to carve out a little piece of post-scarcity within the wider capitalist world.

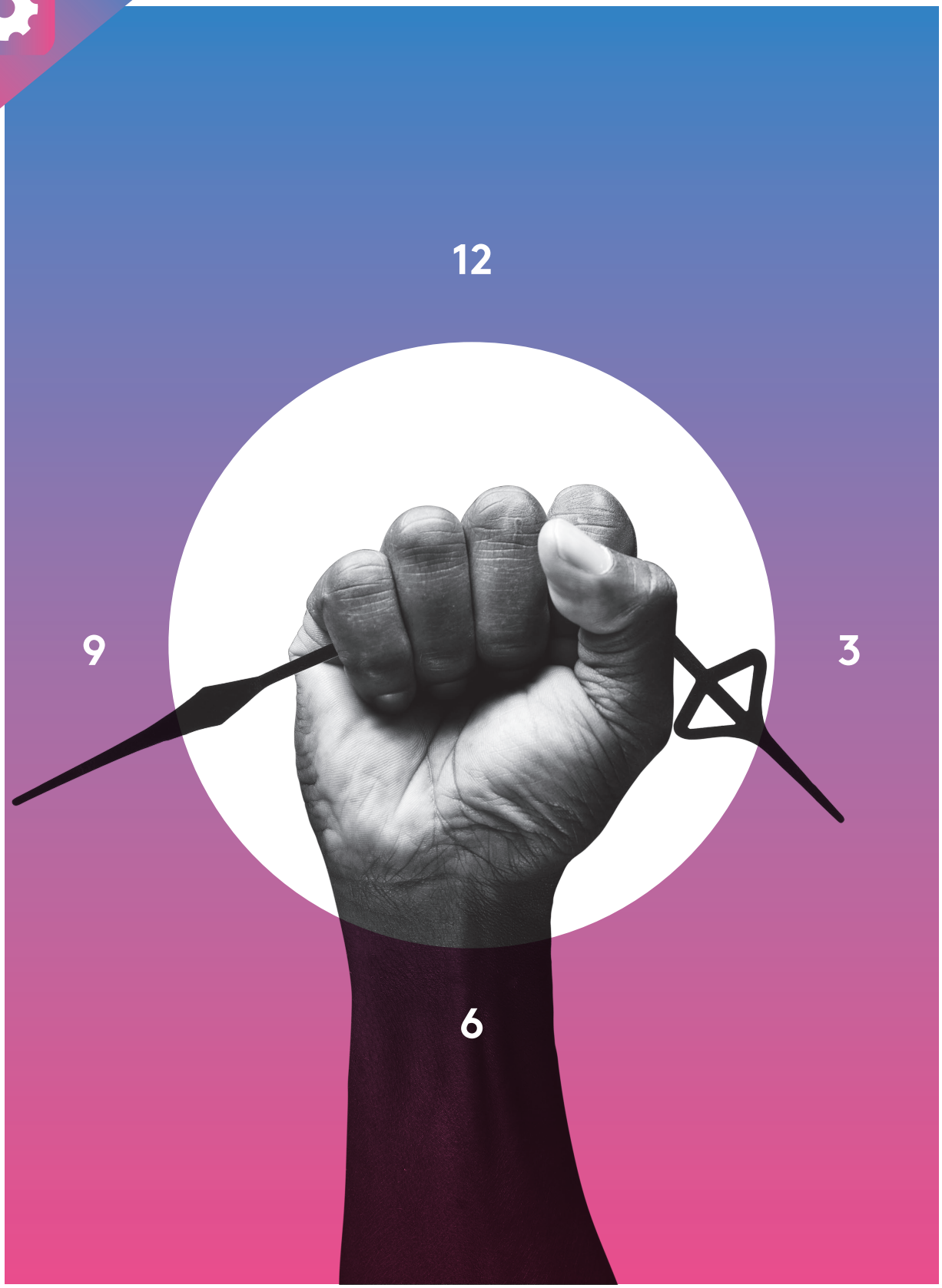
Dockworkers, of course, do not generalize well to the broader working class. Because of their strategic position at the choke points of commodity distribution, and their resulting ability to shut down large parts of the economy, they enjoy a strategic leverage that most of us lack. Moreover, they were ultimately unable to protect their bubble and have suffered a series of recent defeats. Winning a share of the fruits of automation for the rest of us requires victory at the level of the state rather than the individual workplace.

This could be done through a universal basic income, a minimum payment guaranteed to all citizens completely independent of work. If pushed by progressive forces, the UBI would be a non-reformist reform that would also quicken automation by making machines more competitive against workers better positioned to reject low wages. It would also facilitate labor organization by acting as a kind of strike fund and cushion against the threat of joblessness.

A universal basic income could defend workers and realize the potential of a highly developed, post-scarcity economy; it could break the false choice between well-paid workers or labor-saving machines, strong unions or technological advancement.

The strength of labor and the development of the forces of production, after all, are dialectically intertwined. Breathless robot hype aside, productivity growth in recent years has in fact been at historic lows, leading some pundits to warn of a "great stagnation." One way to explain this is that when workers are cheap and controllable, it is easier for the boss to treat the worker herself as a machine than to find a machine to replace her. Thus, the strengthening of the working class both inside and outside the workplace becomes the force that pushes us toward the utopian ideal of a post-scarcity society and the abolition of wage labor. ■

progressive assembly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Technology and Socialist Strategy

With powerful class movements behind it, technology can promise emancipation from work, not more misery.

Paul Heideman

"Anything but capital." For mainstream economists, that's the unspoken rule governing talk of what's to blame for inequality. From Greg Mankiw's petulant response to Occupy to Tyler Cowen's argument that technology has rendered the middle class obsolete, those tasked with explaining economics to Americans are eager to exonerate the rich.

Cowen's argument in particular develops a theme that has become increasingly prominent in the debate over inequality. Confronted with irrefutable evidence of the rise of the 1%, many economists have taken refuge in the idea of "skills-biased technological change." They say that technological progress has eliminated demand for the skills of much of the working population, while rewarding those who possess talents that fit the new economy.

In a different period, this wcould have been a risky position to hold. The idea that technological progress would deliver the goods to all sectors of society has always been a key part of American ideology. Today, however, with oppositional movements in retreat, only the inevitability of technological progress remains. Where technological development once held the promise of smoothing over the rough edges of American society, it has now been put forward as the explanation for these rough spots, and as a justification for their permanence.

Some, however, are unwilling to give up on technology's utopian potential. An organization calling itself the Institute of Customer

Experience — a subsidiary of Human Factors International, Inc. — submitted a bold plan (on Indiegogo, of course) to tackle the scourge of inequality head on. The plan was an app called Equalize. In the short video accompanying the pitch, ICE's CEO, Apala Lahiri Chavan (who goes by "FuturistApala" on Twitter) offers users the opportunity to reduce inequality in six key areas, from gender to hunger to happiness. This can be done through a smartphone app that allows users to accrue points, called "smileys," by doing various kinds of volunteer work, from donating books to mentoring children.

This kind of gamification promises solutions to inequality that will come faster and more efficiently than governments can deliver them by "channelizing user agency." Inequality? There's an app for that!

Technophobia might seem to be the only response from the Left. For every injustice, we are presented with a purportedly politically neutral tech-based solution, which promises to solve the problems of the dispossessed without ever disturbing the privileges of the powerful. In such a depoliticized climate, it is no surprise that some radicals have come to be suspicious of technology, to see social relations of domination inscribed in the forces of production themselves.

Such an attitude, however justified, does an injustice to the legacy of socialist thinking on technology. From the beginning of the modern workers' movement, concerns about the place of technological progress in the attempts to confront "the social problem" have been central to socialist theory. If we examine some of the positions that shaped socialist thinking on technology, we can use them to reconstruct a role for those who refused to let what Brecht called "the new bad things" rest in the hands of gamifiers and disruptors.

Marx and the Sorcerer's Spell

Technological progress was at the heart of Marx's thinking about capitalist society and the problems of socialist transformation. Unlike the utopian socialists who preceded him, Marx was adamant that his was a scientific socialism, in keeping with the latest developments in human knowledge.

Such a position actually drastically understated the degree to which thinkers like Robert Owen and Charles Fourier were themselves children of the Enlightenment, committed to the rational self-government of humanity. Yet it was still a powerful rhetorical move to draw a line dividing the scientific from the utopian.

But Marx's engagement with science and technology was far deeper than mere jockeying for hegemony in the socialist movement. He was the first to specify where capitalism's incredible technological dynamism came from. While bourgeois economists like Adam Smith saw the division of labor and the development of the market as an inevitable source of technological progress, Marx saw the class fault lines that underlie this process.

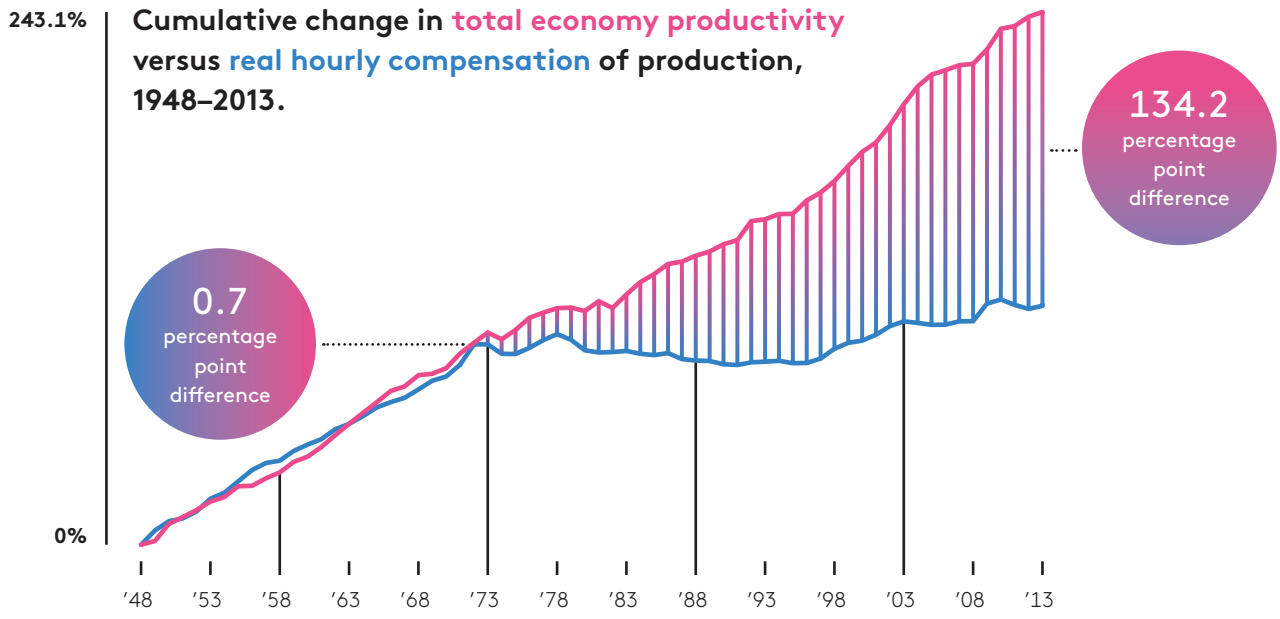
Even more importantly, he recognized the technological productivity of capitalism as one of its most central virtues. Without the surplus capitalism created, egalitarianism simply meant the generalization of want. In the *Communist Manifesto*, Marx was even more rhapsodic in his praise:

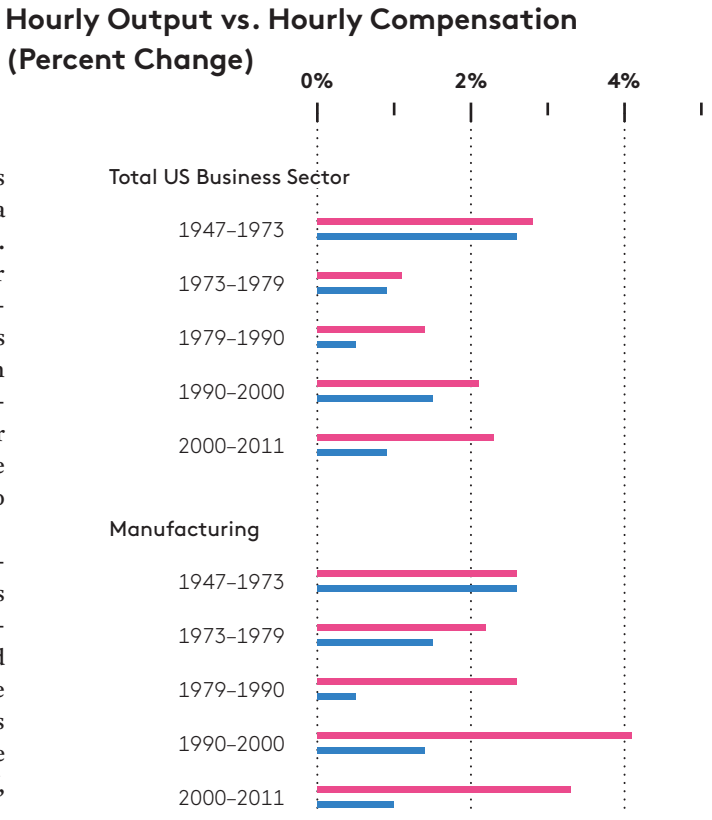
> The bourgeoisie, during its rule of scarce one hundred years, has created more massive and more colossal productive forces than have all preceding generations together.

Clearly, Marx was no technophobe. Yet closely following this passage comes one of the most famous in all of his writings. Referencing Goethe, he describes capital as "the sorcerer who is no longer able to control the powers of the nether world whom he has called up by his spells." As S. S. Prawer points out in *Karl Marx and World Literature*, Marx's allusion actually contains a significant modification of Goethe's original. After all, in Goethe it is the sorcerer's apprentice who loses control, while for Marx it is the sorcerer himself. There will be no responsible adult coming in to clean up capital's mess. For Marx, the productivity and the anarchy of capitalism were linked at its core.

Marx's critique of capital's destructiveness in the *Manifesto* is in line with his conception of scientific socialism. As a good Enlightenment radical, he turned rationalist values back against the system that claimed to exemplify them. Where ideologues from Smith to Bentham claimed that capitalism embodied

Show Me the Money





rationality with its unleashing of human powers to innovate, Marx saw that these claims masked a fundamental irrationality at the heart of the system.

In capitalism, we see crises "that, in all earlier epochs, would have seemed an absurdity — the epidemic of over-production." The system conjures ever-greater levels of productivity out of human labor, while simultaneously placing that productivity ever further beyond human control. Marx, for whom conscious power over one's destiny was the supreme good, saw in this contradiction the key to capitalism's undoing.

While he focused on the systemic irrationalities of capital, Marx was also attentive to the class nature of its technological injustices. Under capitalism, the worker is "daily and hourly enslaved by the machine," to which he becomes a "mere appendage," expendable and exploited. The class character of technological progress would receive even more attention in the *Grundrisse* and *Capital*,

Source: The State of Working America

where Marx explored in further detail the consequences of mechanization and the class struggles to which it gave rise.

Marx's legacy on technology is thus a complicated one, constituted by two sets of oppositions. First, because of its technological dynamism, he saw in capital both the damnation and the salvation of humanity. Refusing either to simply accept or reject the character of technological progress under capitalism, Marx instead dissected it, identifying its driving forces and its potential place in the process of social transformation. Second, Marx attended to both the society-wide forms of irrationality unleashed by capitalism's productivity, such as economic crises, and class-specific forms of domination, such as the impact of mechanization on workers.

In effect, Marx carved out a novel space in debates about technology that would outlive him by more than a century. The generation of socialists after Marx failed, by and large, to hold this space, instead finding themselves on one or the other side of the contradictions he sought to transcend.

Socialists in the Age of Taylor

The socialists who confronted World War I and its attendant horrors faced a very different world from the one Marx left in 1883. In the intervening decades, science had progressed with frightening alacrity, as evidenced by mustard gas and the machine gun. Moreover, the class character of this change had become increasingly obvious, as Taylorism and scientific management sought to subject the factory's workers to the same principles as its machines.

The rise of these new kinds of scientific knowledge was the occasion of a good deal of debate within the socialist movement. Positions ranged from outright rejection to the most ecstatic embrace of the new technologies of efficiency. Across this spectrum, however, socialists failed to hold on to Marx's theoretical and political achievements, falling back into a one-sidedness that left them unable to confront key aspects of their conjuncture.

The Industrial Workers of the World (IWW) were the purest example of the rejectionist impulse in World War I–era socialism. Celebrated by the Left for its militancy, the IWW achieved particular infamy as an advocate of sabotage. Big Bill Haywood famously declared at Cooper Union that "I don't know of anything that can be applied that will bring as much satisfaction to you, as much anger to the boss as a little sabotage in the right place at the right time. Find out what it means. It won't hurt you and it will cripple the boss."

For this, Haywood and other left-wingers were driven out of the Socialist Party of America (SPA) and had to organize the Wobblies without the support of a much larger organization. Far from retreating, however, the IWW expanded its advocacy of sabotage, elevating it to a principle that encompassed far more than machine-breaking. During the remarkably bitter 1912 Patterson strike, which the Wobblies led, only $25 worth of damages to plant property was reported. For the IWW, sabotage meant the conscious withdrawal of efficiency, by whatever means. Sabotage was simply the assertion that workers themselves had the right to govern the pace and level of effort at which they would work.

In the context of Taylorism and scientific management, this was nothing less than a declaration of war against employers, and the Wobblies knew it. Much of their struggle was self-consciously directed against the "efficiency men," who were actively stripping away what little control workers still had over their workplace. The IWW recognized that the scientific management of labor, which encompassed everything from time and motion studies to the introduction of the assembly line, represented a disaster for the working class, and fought against it accordingly.

William English Walling, a Socialist Party left-winger and advocate for the Wobblies, argued that "in proportion as the scientific methods of increasing efficiency are applied in industry, one of the laborer's best and most natural weapons is the scientific development of methods of interfering with efficiency." For the Wobblies, the goal was to throw a wrench in the gears of progress, literally if need be.

The Wobblies' struggle against Taylorization was, of course, completely justified. Yet in their steadfast rejection of technological change, they undermined elements of that struggle. In this, as

in so much else, the IWW was far more concerned with destroying the current order than with constructing a new one.

Their ultra-leftism, manifested in a disinterest in ever signing contracts with employers, kept them utterly unable to conduct a tactical retreat when need be. This is always an important maneuver for workers who are generally outmatched by capital, but particularly crucial in the struggle to withdraw efficiency.

After all, if the workers are too successful in such a withdrawal, their employers will simply be driven out of business by firms who more successfully dominate their workers. In such situations, the ability to negotiate a temporary retreat that preserves class power is crucial, and the Wobblies' neglect of the pro-technology impulse in the socialist legacy prevented them from doing so. In this, as in the IWW's efforts more generally, a simple rejection of capital's demands proved insufficient to overcome them.

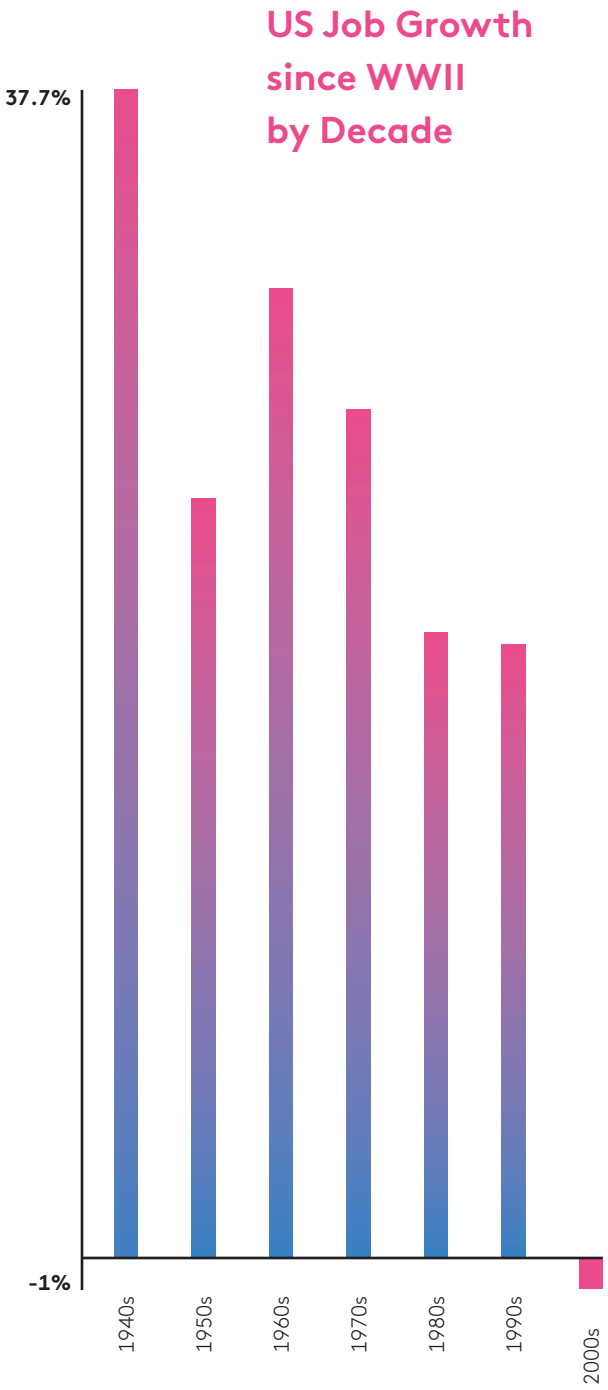
In Soviet Russia …

The early days of the Soviet Union saw a much more lively debate over the principles of scientific management. Before the revolution, Vladimir Lenin had expressed an ambivalent attitude toward Taylorism. In a 1914 article, "The Taylor System — Man's Enslavement by the Machine," he both inveighed against the system's barbarism and pondered its implications for socialist construction.

Lenin was clear about the class content of Taylorism. In an earlier article on the subject, he had declared that "advances in the spheres of technology and science in capitalist society are but advances in the extortion of sweat." In "The Taylor System," he noted that the gains in efficiency scientific management brought with it never went to workers, but brought them only overwork and unemployment.

But what held Lenin's attention about Taylorism was both the productivity it promised and the waste it generated. He noted with disappointment that "this rational and efficient distribution of labor is confined to *each factory*," while the economy as a whole was still ruled by the anarchy of the market. Lenin looked forward to the day when workers would control the economy, and held firmly that

No Jobs for the Weary



they would "be able to apply these principles of rational distribution of social labor when the latter is freed from its enslavement by capital." For Lenin, Taylorism was barbaric in its current form, but could easily be redeployed by workers in a socialist society.

After the October Revolution, the Bolsheviks put these ideas to work. In a country brutalized first by imperialist and then by civil wars, the issue of labor productivity was far more urgent than in Lenin's prewar explorations. In Taylorism, Lenin and other leading Bolsheviks saw a potential solution to the problem of scarcity. They hired efficiency experts from the United States and got to work transforming Soviet labor.

The discussion of Taylorism in the Bolshevik party soon developed into a debate with two main wings. The first, grouped around Alexei Gastev, was enthusiastic about the potential time and motion studies held for Russian workers, and set about organizing laboratories for conducting such studies. A second group, still committed to efficiency in production, but less enamored of the scientific pretensions of Taylorism, would eventually form an organization calling itself *Liga Vremya* — the Time League. These two groups would spar throughout the Soviet Union's early years.

Gastev held that techniques of scientific management had much to offer Russian workers. Aside from raising the standard of living, the scientific reorganization of the factory was objectively in the interest of workers. Faced with the choice between a chaotic factory and one organized efficiently, Gastev had no doubt which the workers would prefer. Propaganda and agitation for Soviet Taylorism could be carried out largely through a demonstration effect.

Gastev's opponents, on the other hand, were far more skeptical about what Taylorism had to offer socialist construction. Instead of remolding the actions of workers along more efficient lines, they emphasized automating undesirable jobs. The *Liga Vremya* rejected what they saw as Taylorism's narrow commitment to efficiency. Rather than simply reorganizing the workplace, they wanted the Communist Party to lead a struggle for reorganizing the entire society along more efficient lines.

Proposals to this end included replacing imprecise language like "perhaps" or "anyhow" with "a

Source: Bureau of Labor Statistics

precise calculation" or "a well thought-out plan" and taking steps to limit the length of speeches at meetings. *Liga Vremya* sought to spread a passion for efficiency throughout the Russian working class by means of agitation and propaganda. They saw Gastev's laboratory as the redoubt of "chronometric barbarism."

Ultimately, Taylorism was not implemented in revolutionary Russia in any systematic way, though this was less the result of organized opposition than the chaos and privation of post-revolutionary society. Later, in the USSR under Stalin, Soviet state officials went to great lengths to increase labor productivity. Notably, however, these efforts relied less on Taylorist redesign and more on moral exhortation. The Stakhanovite movement, which sought to convince workers to follow the example of a coal miner who had set new production records, is representative of this tendency.

Nonetheless, the debate over Taylorism in the early Soviet state testifies to the dominance of efficiency concerns in Soviet discussions of scientific management. The desperation and fragility of Soviet society no doubt contributed to this concern, but as Lenin's prewar writings show, a fascination with the potentialities of Taylorism ran deep in Bolshevik thought. While attentive to both the systemic irrationalities of capitalism and the necessity of technological progress for a socialist reorganization of society, Soviet writers remained comparatively blind to the class character of Taylorism.

Gramsci's Fordist Romance

The most enthusiastic socialist support for Taylorism in the World War I era came not from the helm of the new Soviet state, however, but from a prison cell. Antonio Gramsci, writing from a fascist prison, was ebullient over the prospects for social transformation of what he called Fordism. Concerned, as always, with the relative backwardness of Italy, Gramsci saw Fordism as threatening to the backwards and parasitic layers of Italian society. Fordism represented the most modernizing impulses in capitalist society. Indeed, Gramsci thought Fordism was such an advance that he was not sure it could be completed under capitalism; perhaps only socialism could consummate its development.

Gramsci believed that Fordism necessitated the transformation of the working class to adapt it to the new methods of industrial production. He held that modern industry demanded "a rigorous discipline of the sexual instincts (at the level of the nervous system) and with it a strengthening of the 'family' … and of the regulation and stability of sexual relations."

To be clear, Gramsci thought this repression of sexual instincts — what he called elsewhere a struggle "against the element of 'animality' in man" — was a good thing. The working class was threatened and repulsed by the "libertinism" of the middle classes, who couldn't remold themselves to the requirements of industrial society. Prohibition in the United States was one aspect of the creation of the new industrial man, and Gramsci held, rather implausibly, that the American working class supported Prohibition but that it was undermined by middle-class bootleggers.

This is not to say that Gramsci was uncritical of Fordism. But his criticism derived almost entirely from the system's implementation in a class society. In capitalism, the remaking of industrial man necessitated by modern techniques of production could only ever half-succeed, as it would always be imposed on workers coercively from the outside. Gramsci argued that Fordism could only be completed when the working class took power, and adapted itself by conscious choice to Fordism's requirements.

In Gramsci's mind, concerns with efficiency came to dominate conceptions of social change. Instead of technology making socialism possible, socialist transformation became a mere means to unfetter the forces of production. Of course, there was always an element of this in Marx. But in Gramsci's paeans to industrial man and sexual discipline, it ascends to the center of the socialist promise.

Gramsci and other socialists throughout the early twentieth century showed themselves unable to maintain Marx's nuance in the face of capital's technological dynamism. We should not judge them too harshly for this. From the challenges of socialist construction to a fascist prison cell, these

revolutionaries were confronted with the social contradictions of science and technology far more sharply than Marx ever was. But we need to acknowledge where they fell short to do better next time.

The New Left and the Machines

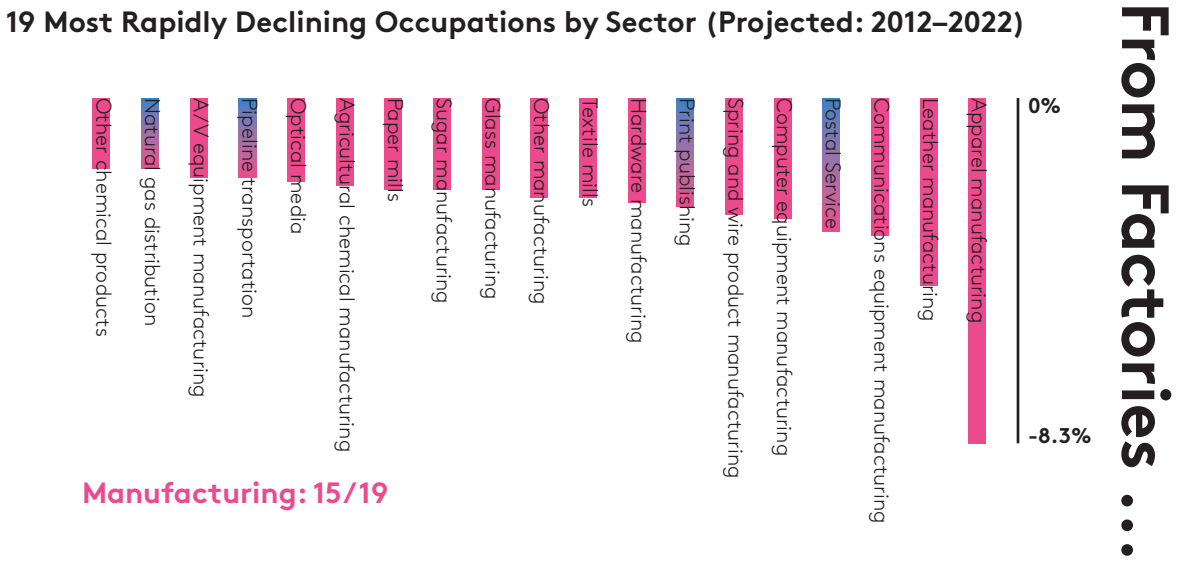
The New Left of the sixties and seventies, while it never led struggles of the magnitude that Lenin and Gramsci did, did a better job holding true to Marx's complicated analysis of the dynamics of technology in capitalism. There are two lines of analysis in particular that are of use to radicals thinking about technology today: Harry Braverman's *Labor and Monopoly Capital* and British socialist Chris Harman's agitational efforts around computerization.

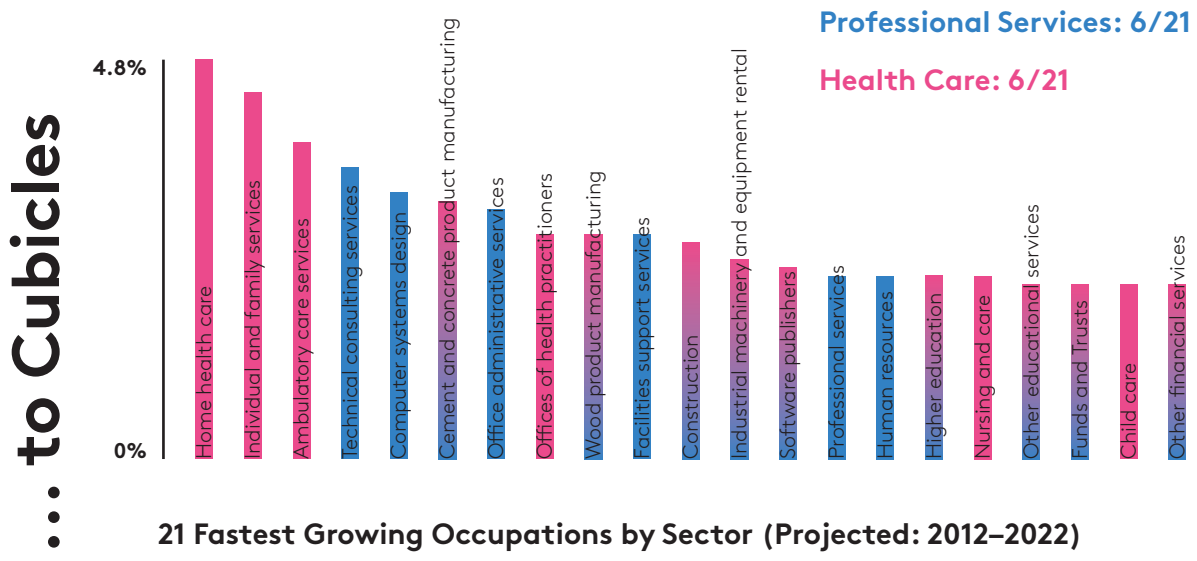
Harry Braverman was an American Trotskyist who, after a long stint as a metalworker, ended up as the managing director of Monthly Review Press, book-publishing arm of the venerable socialist magazine. While there, he wrote *Labor and Monopoly Capital*, which drew on both his own experience in the workplace and an extensive study of management theory from Frederick Winslow Taylor to Peter F. Drucker.

Braverman concluded that Taylorism was the heart of the modern practice of managing labor. But what he meant by Taylorism was quite different from what most people associated it with. In popular culture as well as on the Left, what stuck out most about Taylorism was its obsession with best practices and efficiency. The stopwatch symbolized this version of Taylorism: a practice of reshaping the labor process to be more efficient.

Braverman argued that this perspective missed the class content of Taylorism, which was itself essential to understanding the endeavor as a whole. Taylorism, he contended, was no abstract practice of improving the efficiency of labor, but rather the practice of managing wage labor in a capitalist society.

Surveying Taylor's extensive work, Braverman concluded that Taylorism could be reduced to three essential principles. First: dissociation of the labor process from the skills of workers. This meant redesigning the labor process so that it was not dependent on the talents workers brought with them. Much industrial production in the late nineteenth century depended on skilled workers, whose knowledge of the production process often far exceeded their employers'; Taylor saw that this gave laborers a tremendous advantage over their employer in the





struggle over the pace of work. Not only could capitalists not legislate techniques they were ignorant of, but they were also in no position to judge when workers told them the process simply couldn't be driven any faster. Work had to be redesigned so that employers did not depend on their employees for knowledge of the production process.

The situation had to be reversed. Braverman called this second principle the separation of conception from execution. Previously, workers had designed much of the labor process themselves, deciding when and how fast to undertake various tasks. Taylor argued that this also weakened employers relative to their workers. The labor process could never be rationalized as long as workers were in control of designing it. Workers would never design a process done by eight workers to be done by seven instead. This sort of change is, of course, what management is always seeking. To achieve it, planning had to be separated from execution within the firm.

This separation enabled the final principle of scientific management — management's use of its monopoly of knowledge and control over production to redesign every aspect of the labor process. Once management had dissociated production from skills and separated conception and execution, it would be in a position to test each moment of the production process, push it to its breaking point, and see where workers could be driven even harder.

The deskilling of work this process inevitably produced was a major boon to employers in the larger class struggle, as it greatly facilitated the use of scabs. It was far easier to find scabs capable of pushing buttons on an assembly line than to find workers with the high skills of the late nineteenth century.

With these three principles, Braverman restored Marx's emphasis on the class implications of technology in capitalist society. Scientific management was no neutral technique for improving efficiency, but a scheme for controlling labor in its struggle with capital. The failure to appreciate this point is clear in Lenin and Gramsci's discussions of Taylorism and Fordism, and leads quite directly to the one-sided conclusions they reached about the applicability of Taylorist techniques in post-capitalist society.

Braverman has often been unfairly accused of neglecting worker agency in his account. This misses his point, which assumes that workers will resist capital's impositions on them and investigates how capital tries to overcome this resistance.

Source: Bureau of Labor Statistics

Nonetheless, it is true that he left more agitational concerns out of the book.

These concerns were developed almost simultaneously with the publication of *Labor and Monopoly Capital*, on the other side of the Atlantic. In 1979, the British working class was clearly facing the beginning of a period of defeat. The wave of struggle that had crested in 1974, bringing down a Conservative government, had receded quickly, and Margaret Thatcher was about to begin her class offensive.

Unsurprisingly, as employers looked at the years of struggle they had just lived through, they turned to mechanization and computerization. One way to deal with volatility in the wage bill was to shift investment from workers to machines. This coincided with the development of computer technology capable of being profitably utilized in an office setting. As such, much of the debate centered around the displacement of various office workers in the UK, who at the time were mostly union members.

This was the context in which the late British socialist Chris Harman wrote a pamphlet entitled *Is a Machine After Your Job?* Harman was a leader of the Socialist Workers Party, which then had a working-class base as a result of its work in the shop stewards' movement. For socialists in the US today, radical groups are almost by definition isolated from the working class, but in 1970s Britain, the agendas of socialist groups were actually put into action by cadres and supporters in workplaces across the country. Harman's pamphlet was an effort to provide a strategic orientation for working-class militants adjusting to a period of retreat.

For our purposes, the most important aspect of the pamphlet is "What to Fight For." For Harman, the key issue was preserving worker control inside the workplace. As he put it: "What we are challenging is not technology but the control over technology by managements committed to profit-making." The strategy he outlined was more nuanced than that of the IWW. Instead of resisting each and every effort to introduce further mechanization into the workplace, he encouraged workers to attach a series of conditions to management's efforts at rationalization, each aimed at preserving working-class power. They included demands like:

- no use of technology for assessing the speed or accuracy of individual workers
- the involvement in discussion of all workers to be affected by technological change, directly or indirectly
- no victimization of workers unable to adjust to new technology
- no speed-ups through natural attrition
- written guarantees from management guaranteeing no introduction of new technology without prior agreement from the union membership

All of these charted a strategy for labor that was accepting of technological change in the workplace, but firmly committed to channeling that change in directions that would not be corrosive to working-class power on the shop floor.

Harman particularly wanted to differentiate his proposed strategy from that being advanced by the union leadership, which simply asked for guarantees against layoffs. This strategy, however, allowed for a more gradual dissolution of union power. Any business undergoes a degree of workforce turnover in a given year, and by simply not replacing people who voluntarily left, employers could impose a higher workload on remaining workers without ever having to lay off anyone. Union strategies that only looked to maintain employment and wage levels, without continuing to challenge management power, allowed employers to accomplish their goals through a kind of drift rather than active restructuring.

For Harman, the ideal goal of any union mobilization around technology was not merely an agreement on the issue at hand, but the positioning of workers to be even stronger for the next confrontation. Like Braverman's analysis, this perspective pointed to a deeper understanding of capital's motives in the introduction of technology than either Lenin or Gramsci evinced. At the same time, his focus on forging agreements with management that allowed rationalization to proceed contingent on the preservation of working-class power offers much more strategically than a blanket rejection of technological change in the workplace.

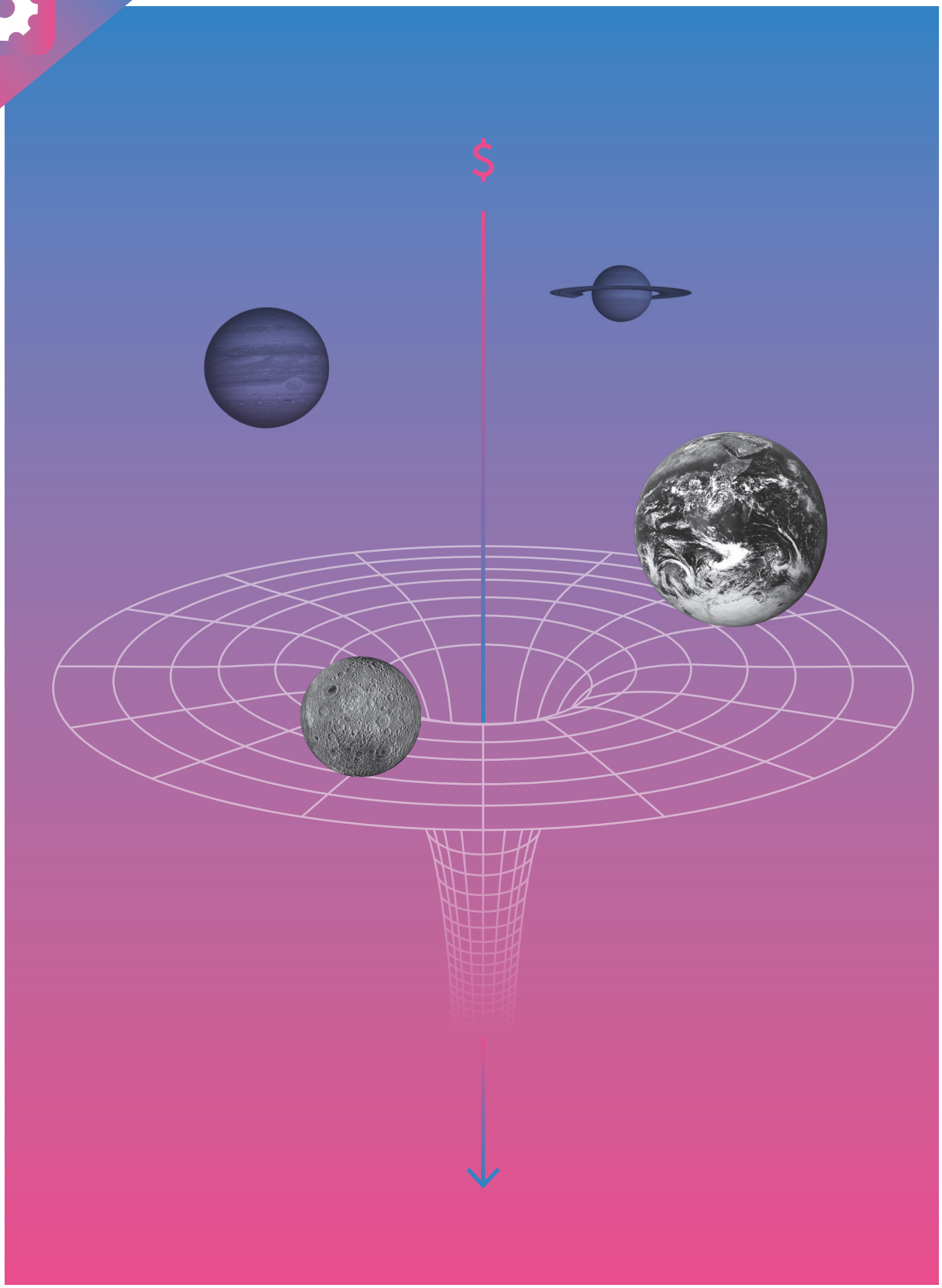
Unplugging Capital

For radicals confronting capitalist technology and its ideologues today, Braverman and Harman have a great deal to offer. Rather than seeing domination inscribed in technological forms, as some radicals today are all too wont to do, Braverman and Harman developed their approaches to technology on the basis of the class context in which it is implemented. Controlled by capitalists, advances in technology are, as Lenin said, advances in the extortion of sweat. But this hardly exhausts the possibilities of technological advance, which as Lenin and Marx saw, can promise emancipation from work, even though today it delivers the opposite.

Their analysis suggests some orientation points for struggles around technology today. Above all, the question of preserving and extending working-class power inside the workplace must be central to these struggles. Crucially, this suggests that approaches to technology that focus primarily on distributional concerns are not enough. Guarantees of employment or even wages and benefits in the face of technological change are simply not enough; the class power of employers is such that agreements like these can all too easily be compatible with the destruction of working-class power on the shop floor. Capital is often perfectly happy to preserve the benefits of the present generation of workers, while ensuring that the next will never have access to them.

This perspective is particularly important today, as the process of rebuilding working-class power throughout the capitalist world will undoubtedly be a long one. Capitalists will continue to introduce new technologies that make working life even worse, and, for the foreseeable future, the technocratic reign of efficiency experts and status-quo disruptors will persist, with all the pathological ideologies they bring with them.

Marx's theorization of the multiple faces of technology under capitalism will be crucial for understanding these processes. But really changing the situation will require formulating a strategy to organize workers and fight back. ■



Democratize the Universe

As humanity pushes outward into space, how will the galaxy's wealth be shared?

Nick Levine

The privatization of the Milky Way has begun.

Last summer, the bipartisan ASTEROIDS Act was introduced in Congress. The legislation's aim is to grant US corporations property rights over any natural resources — like the platinum-group metals used in electronics — that they extract from asteroids.

The bill took advantage of an ambiguity in the United Nations' 1967 Outer Space Treaty. That agreement forbade nations and private organizations from claiming territory on celestial bodies, but was unclear about whether the exploitation of their natural resources would be allowed, and if so, on what terms.

The legal framework governing the economic development of outer space will have enormous effects on the distribution of wealth and income in the Milky Way and beyond. We could fight for a galactic democracy, where the proceeds of the space economy are distributed widely. Or we could accept the trickle-down astronomics anticipated by the ASTEROIDS Act, which would allow for the concentration of vast amounts of economic and political power in the hands of a few corporations and the most technologically developed nations.

Given the pressing problems of inequality and climate change on Earth, the US left has been understandably uninterested in or largely dismissive of any space pursuits. For this reason, it remains unprepared to organize around extraterrestrial economic justice. The Left's rejection of space has effectively ceded the celestial commons to the business interests who would literally universalize laissez-faire.

Organizing around extraterrestrial politics wasn't always treated as an escapist distraction. In the 1970s, fighting for a celestial commons was a pillar of developing countries' struggle to create a more equitable economic order.

Starting in the 1960s, a coalition of underdeveloped nations, many recently decolonized, asserted their strength in numbers in the

United Nations by forming a caucus known as the Group of 77. In the early 1970s, this bloc announced its intention to establish a "new international economic order," which found its expression in a series of UN treaties governing international regions, like sea beds and outer space, that they hoped would spread the economic benefits of the commons more equitably, with special attention to less developed nations. For these countries — as well as for the nervous US business interests that opposed them — their plan to "socialize the moon," as some put it at the time, was the first step toward a more egalitarian distribution of wealth and power in human society.

It will be years before the industrialization of outer space is economically viable, if it ever is. But the legal framework that would shape that transition is being worked out now. The ASTEROIDS Act was submitted on behalf of those who would benefit most from a laissez-faire extraterrestrial system. If we leave the discussion about celestial property rights to the business interests that monopolize it now, any dream of economic democracy in outer space will go the way of jetpacks, flying cars, and the fifteen-hour workweek.

As Below, So Above

Left critics of space proposals make the same mistakes as the most techno-utopian starry-eyed industrialists. From the point of view of the latter, celestial development will provide ultimate salvation to the human race by making us a multi-planetary species; the former see outer space as an infinite void essentially antagonistic to human life, interest in which is only orchestrated for cynical political ends. Each side misconceives extraterrestrial pursuits as qualitatively different from economic activities on Earth.

Venturing into space may be a greater technical challenge; it may cost more, be more dangerous, or be a mistaken use of resources. But to understand these prospects in existential terms rather than as a new episode in the familiar history of industrial development and resource extraction — with all the political-strategic dangers and organizing opportunities that come with them — is to be blinded by the space romanticism that is a peculiar vestige of Cold War geopolitics.

Whether and how we should go to space are not profound philosophical questions, at least not primarily. What's at stake is not just the "stature of man," as Hannah Arendt put it, but a political-economic struggle over the future of the celestial commons, which could result in a dramatic intensification of inequality — or a small step for humankind toward a more egalitarian state of affairs on our current planet.

Undoubtedly, there are good reasons to be skeptical about going to space. Some have argued that it shifts attention away from solving the difficult problems of economic and environmental justice on Earth — think of Gil Scott-Heron's spoken-word poem "Whitey on the Moon," which juxtaposes the deprivation of the American underclass with the vast resources diverted to space.

Scott-Heron's critique is powerful, but it's important to remember that he was denouncing an unjust economic system. He wasn't issuing a timeless condemnation of space pursuits as such. Whether the aims of providing for all and developing outer space are mutually exclusive depends on the political forces on the ground.

We might also question whether mining asteroids would be detrimental to our current planet's environment in the medium term. If we don't find a renewable way to blast off into outer space, the exploitation of these resources could lead to an intensification of, not a move away from, the fossil-fuel economy.

If the environmental impact of space mining turns out to be large, it would be analogous to fracking — a technological development that gives us access to new resources, but with devastating ecological side effects — and ought to be opposed on similar grounds. On the other hand, some speculate that mining the Moon's Helium-3 reserves, for example, could provide an abundant source of clean energy. The terrestrial environmental impact of space activity remains an open question that must be explored before we stake our hopes on the economic development of outer space.

Philosophers have suggested that we might have ethical duties to preserve the "natural" states of celestial bodies. Others fear that our activities might unknowingly wipe out alien microbial life.

We should remain sensitive to the aesthetic and cultural value of outer space, as well as the potential for extinction and the exhaustion of resources misleadingly proclaimed to be limitless.

But if the Left rejects space on these grounds we abandon its fate to the will of private interests. These concerns shouldn't cause us to write off space altogether — rather, they should motivate us even more to fight for the careful, democratic use of celestial resources for the benefit of all.

There is also reason to be cautiously optimistic about extending economic activity to outer space. For one, the resources there — whether platinum-group metals useful in electronics, or fuels that could be central to the semi-independent functioning of an outer space economy — have the potential to raise our standards of living. Imagine, a superabundance of asteroid metals that are scarce on Earth, like platinum, driving the sort of automation that could expand output and reduce the need to work. Of course, there's nothing inevitable about the benefits of productivity gains being distributed widely, as we've seen in the United States over the past forty years. This is a problem not limited to space, and the myth of the "final frontier" must not distract us from the already existing problems of wealth and income distribution on Earth.

While the industrialization of the solar system isn't a panacea for all economic ills, it does offer a significant organizing opportunity, since it will force a confrontation over the future of the vast celestial commons. The democratic possibilities of such a struggle have been recognized before: one conservative American citizens' group in the 1970s called a progressive UN space treaty a "vital component of Third World demands for massive redistribution of wealth so as ultimately to equate the economic positions of the two hemispheres." Many in the 1970s identified the egalitarian potential in the development of outer space, and the Left must not overlook it today.

Back to the Future

One of the Group of 77's major goals was to apply some of the redistributive functions of the welfare state on a global scale. In 1974, that coalition issued a "Declaration on the Establishment of a New International Economic Order," which called for a fairer system of global trade and resource distribution, one that could alleviate historical inequality. One of the battlegrounds for the Group of 77 was the negotiation over extraterrestrial property rights.

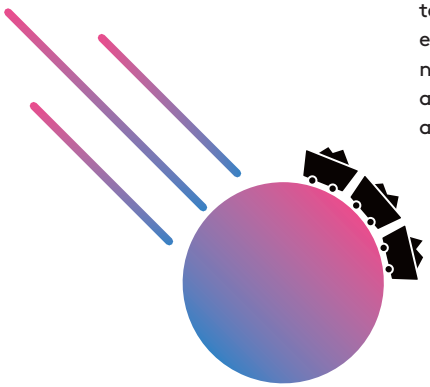
The Outer Space Treaty of 1967, signed by over ninety countries in the heat of the first sprint to the moon, rejected the notion that celestial bodies fell under the legal principle of *res nullius* — meaning that outer space was empty territory that could be claimed for a nation through occupation. It forbade the "national appropriation by claim of sovereignty, by means of use or occupation, or by any other means" of outer space.

But the treaty was not just restrictive. It also had a positive requirement for extraterrestrial conduct: "The exploration and use of outer space," it declared, "shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind." However, nobody knew what this would mean in practice: was it a call for egalitarian economics, or an empty proclamation of liberal benevolence?

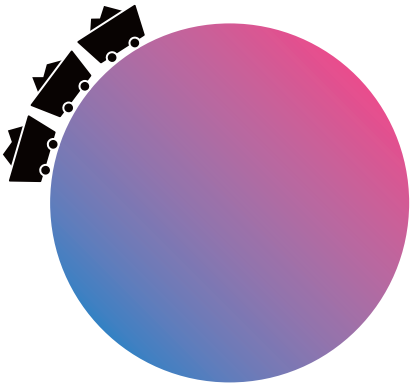
Complicating matters, it was unclear whether the extraction and sale of natural resources from outer space fell under the category of "appropriation," which had been forbidden. And what exactly was this benefit to all countries that our outer space pursuits were supposed to bring? How would its distribution be enforced? Which interpretation would win out was more a question of political power than of esoteric legal maneuvers.

The Group of 77 took an activist approach to these issues, proposing amendments to the Outer Space Treaty regime that would spread the economic benefits of the celestial commons to less developed countries that did not have the resources to get to space, let alone mine it. Thus in 1970, the Argentine delegate to the UN Committee on the Peaceful Uses of Outer Space proposed to legally designate outer space and its resources "the common heritage of mankind." First applied in negotiations over maritime law a few years earlier, the "common heritage" concept was intended to give legal grounding to the peaceful international governance of the commons.

John Galt Space Academy

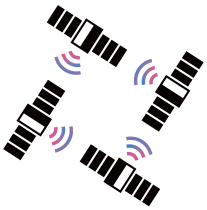


Deep Space Industries plan to offer in-space resource-extraction services beginning next year, boasting that a single asteroid may be worth as much as $195 billion.

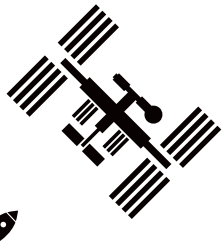


With the collaboration of NASA, Silicon Valley startup Moon Express plans to mine the moon for platinum metals, Helium-3, and "rare moon rocks."

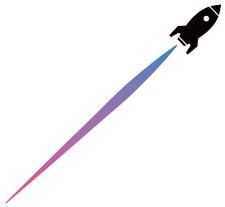
LA startup ConnectX wants to launch hundreds of data-storage satellites and launch a new paradigm of "space computing."



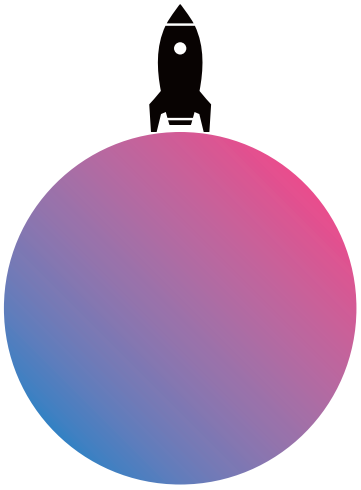
Bitcoin developer Jeff Garzik plans to launch satellites to beam the Bitcoin blockchain to Earth.



Extreme travel firm Space Adventures began offering occasional private trips to the International Space Station in 2001. Ticket prices reached $30 million.



"Commercial spaceline" Virgin Galactic is actively developing commercial spacecraft and may soon offer opportunities for private space tourism to the globetrotting superwealthy. They have $80 million dollars in deposits.



Tesla Motors CEO Elon Musk plans to develop a second Internet in outer space to connect his projected 1 million settler-colonists on Mars by the century's end. This project will involve hundreds of satellites and is expected to cost $10 billion.

Las Vegas startup Bigelow Aerospace plans to capitalize on the ample real estate in space by creating for-rent "habitable space stations suitable for corporate communities."

As an alternative to the laissez-faire approach advocated by many private interests, the "common heritage" principle also provided a legal framework for the democratic distribution of revenues derived from the international commons. In 1973, the Indian delegation to the Committee on the Peaceful Uses of Outer Space tried to put this idea into celestial practice, proposing an amendment to the Outer Space Treaty that called for equitable sharing of space benefits, particularly with developing countries.

The Brazilian delegate to the committee summarized the group's position: "It does not seem justifiable … that space activities … should evolve in a climate of total laissez-faire, which would conceal under the cloak of rationality new ways for an abusive exercise of power by those who exert control over technology." Despite opposition from both the Soviet Union and the United States, the final draft of this new outer space agreement included a version of the "common heritage of mankind" doctrine.

When the finalized treaty was brought to the US in 1979 for ratification, business groups balked. The vision of egalitarian galactic democracy suggested by the document was rightly seen as contrary to narrow American interests. The United Technologies Corporation, a designer and manufacturer of aircrafts and other heavy machinery (including the Black Hawk helicopter) took out a large advertisement in the *Washington Post* and a number of other newspapers, warning that the treaty would establish an "OPEC-like monopoly, require mandatory transfer of technology, and impose high international taxes on profits as a way of shifting wealth from the developed to the less developed countries."

The president of the corporation, Alexander Haig, also testified against the treaty in Congress in 1979, warning that "the common heritage concept expressed in the treaty underlies Third World efforts directed at a fundamental redistribution of global wealth." Haig was hired as Ronald Reagan's Secretary of State in 1981, and political opposition to the bill forced NASA's chief counsel to abandon defense of the treaty.

In the end, the Moon Treaty, as the 1979 document came to be known, failed to gain more than a few signatories, leaving open the question of how the benefits of outer space were to be shared. In 1988, a different coalition of developing countries added the question of space benefits to the UN outer space committee's agenda. But they failed to gain traction, and by 1993 they had to concede, as two long-time delegates to the outer space committee put it, that "their attempt [at] a redistributive revolution in international space cooperation had failed."

The conversation had shifted from the distribution of economic benefits to a narrower emphasis on international scientific coordination and development aid. This retreat culminated in a 1996 declaration that limited the interpretation of the "benefit" clause of the Outer Space Treaty to vague promises to help less developed countries improve their space technologies.

The ultimate failure of the Moon Treaty was representative of broader developments in international politics, as the influence of the Group of 77 declined. The fact that the structural adjustment policies of the Washington Consensus won out over the Third World's redistributive goals was the result of contingent factors — the oil shock's exacerbation of debt crises, for instance — but it also indicated the limits of the power the Group of 77 had wielded in the first place.

In October 2014, the UN outer space committee issued a press release summarizing its most recent session. Its headline: "Outer Space Benefits Must Not Be Allowed to Widen Global Gap between Economic, Social Inequality, Fourth Committee Told." Despite paying lip service to its past concerns, the outer space committee now emphasizes equal access, voluntary technology transfers, and modest development aid over the direct redistributive approach it took in the 1970s.

This shift from struggling for equality of outcome to equality of opportunity, with no accountability mechanism in place to ensure even the latter, represents a striking regression. The egalitarian dreams of the "revolution of the colonized" in the UN, as it was called at the time, have been forgotten.

The Empire Strikes Back

Recent US plans for outer space development, shaped overwhelmingly by Silicon Valley's intuitions and capital, stand in stark contrast to the futuristic democratic dreams of the Group of 77.

The most prominent of these entrepreneurial visions has been Elon Musk's plan to colonize Mars. For now, international law seems to unequivocally forbid territorial claims on Mars and other celestial bodies.

The legal status of resource extraction, on the other hand, remains an open question. A vocal group of entrepreneurs is hoping to set a precedent for the private appropriation of natural resources from asteroids, without internationally redistributive obligations. Planetary Resources, an asteroid-mining company whose backers include Larry Page, Eric Schmidt, and James Cameron, plans to launch satellites to prospect for valuable asteroids in the next two years. Another US firm, Deep Space Industries, will launch exploratory satellites as soon as next year. These entrepreneurs hope to extract the valuable platinum-group metals, essential for manufacturing electronics, that are rare on Earth. Sensationalist articles on space mining will tell you about an asteroid worth $20 trillion.

Investors also believe that asteroids might provide water that could be broken down into oxygen and hydrogen in space, yielding air for astronauts and fuel for their ships. This could facilitate a dramatic acceleration in the economic development of outer space. The CEO of Deep Space Industries said he hopes asteroids near Earth will be "like the Iron Range of Minnesota was for the Detroit car industry last century — a key resource located near where it was needed. In this case, metals and fuel from asteroids can expand the in-space industries of this century. That is our strategy." Another entrepreneur called the industrialization of outer space the "biggest wealth-creation opportunity in modern history."

Before this value can be generated, however, the legal wrinkles have to be ironed out. And so in the summer of 2014, the ASTEROIDS Act was introduced in the House of Representatives to "promote the right of United States commercial entities to explore and utilize resources from asteroids in outer space, in accordance with the existing international obligations of the United States, free from harmful interference, and to transfer or sell such resources."

The legislation was intended to clarify US interpretations of international space law, explicitly granting American companies the right to extract asteroid resources and bring them to market. The conclusion of Congress' last session means that the bill will have to be reintroduced for it to move forward, and it is uncertain exactly when and how this will happen. But its appearance marked another clear attempt to unilaterally push international norms toward the free extraction of outer space resources, with limited democratic responsibilities attached — and it will not be the last.

Joanne Gabrynowicz, editor emerita of the *Journal of Space Law*, said that an adviser to Planetary Resources had drafted the bill. Deep

Space Industries also sent a letter supporting it directly to the space subcommittee of the House of Representatives. Moreover, Congressman Bill Posey, a cosponsor of the act, represents Florida, a state that Gabrynowicz pointed out has recently been forced to try to attract commercial space business — a direct response to the economic hardship caused by the decommissioning NASA's space shuttle program. Such extraterrestrial special interests will no doubt continue to exert legislative pressure.

In addition to asteroids, companies are investing millions in mining the moon, despite legal uncertainties. One such company, Moon Express, has already received a $10 million data-sharing contract from NASA. One of that company's founders, a former dot-com billionaire, told the *Los Angeles Times*:

> There is strong legal precedent and consensus of "finders, keepers" for resources that are liberated through private investment, and the same will be true on the moon. You don't have to own land to have ownership of resources you unlock from it. Moon Express will use existing precedents of peaceful presence and exploration set by the US government forty years ago.

This redeployment of the finders-keepers principle is anathema to the redistributive regime imagined by the Group of 77. Private companies like Planetary Resources and Moon Express, with support from the federal government, are betting not only on the viability of space industrialization, but also on their ability to push through a legal regime that will validate their property claims on their terms. But the universalization of laissez-faire is not inevitable.

Final Frontier Thesis

The history of the Moon Treaty serves as a reminder that outer space is not just a screen onto which we project techno-utopian fantasies or existential anxieties about the infinite void. It has been, and will continue to be, a site of concrete struggle over economic power.

The politics of the present are undoubtedly different from those of the 1970s. The egalitarian project of the Group of 77 has given way to BRICS-style market liberalism. Global capital has gained power where international labor efforts have stagnated. Domestic inequalities have skyrocketed. The rapid proliferation of information technologies has temporarily masked the reality that the future, to paraphrase William Gibson, is not being very evenly distributed.

Without international political organization to challenge galactic market fundamentalism, a twenty-first century space odyssey could mean the concentration of even more wealth and income in the hands of a few powerful corporations and the most technologically advanced countries. At the same time, and for the same reasons, the prospect of preserving the final frontier as a celestial commons presents an opportunity to fight for a more democratic political economy.

Sharing the benefits of the celestial commons is key to expanding democracy to a galactic scale. One time-tested means of distributing the benefits of natural-resource extraction universally is the sovereign wealth fund, which Alaska uses to deliver oil revenue to its residents. As an international commons, outer space offers an opportunity to experiment with such redistributive mechanisms beyond the traditional confines of the nation-state.

Organizing around an issue of such scale may seem utopian, but it's also necessary. From regulating capital to mitigating climate change, the problems that confront us are inherently global in scope and require commensurate strategies.

At the very least, the global left ought to demand the creation of an independent Galactic Wealth Fund to manage the proceeds of outer space resources on behalf of all human beings. At first, it would amount to little, divided up among all of us. But as the space economy grows relative to the terrestrial one, social dividends from the Galactic Wealth Fund could provide the basis for a truly universal basic income.

This is just one component of a broader platform for galactic democracy that must be developed collectively. Extraterrestrial economic justice — not just shiny technological advances — will be central to any truly egalitarian politics in the twenty-first century. It's time to start building a democratic futurism. ■


short
circuit


9:41 AM

The Smartphone Society

Just as the automobile defined the twentieth century, the smartphone is reshaping how we live and work today.

Nicole Aschoff

The automobile was in many respects the defining commodity of the twentieth century. Its importance didn't stem from technological virtuosity or the sophistication of the assembly line, but rather from an ability to reflect and shape society. The ways in which we produced, consumed, used, and regulated automobiles were a window into twentieth-century capitalism itself — a glimpse into how the social, political, and economic intersected and collided.

Today, in a period characterized by financialization and globalization, where "information" is king, the idea of any commodity defining an era might seem quaint. But commodities are no less important today, and people's relationships to them remain central to understanding society. If the automobile was fundamental to grasping the last century, the smartphone is the defining commodity of our era.

People today spend a lot of time on their phones. They check them constantly throughout the day and keep them close to their bodies. They sleep next to them, bring them to the bathroom, and stare at them while they walk, eat, study, work, wait, and drive. Twenty percent of young adults even admit to checking their phones during sex.

What does it mean that people seem to have a phone in their hand or pocket everywhere they go, all day long? To make sense of our purported collective phone addiction, we should follow the advice of Harry Braverman, and examine the "machine on the one side

and social relations on the other, and the manner in which these two come together in society."

Hand Machines

Apple insiders refer to FoxConn's assembly city in Shenzhen as Mordor — J. R. R. Tolkien's Middle Earth hellhole. As a spate of suicides in 2010 tragically revealed, the moniker is only a slight exaggeration of the factories in which young Chinese workers assemble iPhones. Apple's supply chain links colonies of software engineers with hundreds of component suppliers in North America, Europe, and East Asia — Gorilla Glass from Kentucky, motion coprocessors from the Netherlands, camera chips from Taiwan, and transmit modules from Costa Rica funnel into dozens of assembly plants in China.

Capitalism's simultaneously creative and destructive tendencies spur constant changes in global production networks, and within these networks, new configurations of corporate and state power. In the old days, producer-driven supply chains, exemplified by industries like auto and steel, were dominant. People like Lee Iacocca and Boeing legend Bill Allen decided what to make, where to make it, and how much to sell it for.

But as the economic and political contradictions of the postwar boom heightened in the 1960s and '70s, more and more countries in the Global South adopted export-oriented strategies to achieve their development goals. A new type of supply chain emerged (particularly in light industries like apparel, toys, and electronics) in which retailers, rather than manufacturers, held the reins. In these buyer-driven models, companies like Nike, Liz Claiborne, and Walmart design goods, name their price to manufacturers, and often own little more in the way of production than their lucrative brands.

Power and governance are located at multiple points in the smartphone chain, and production and design are deeply integrated at the global scale. But the new configurations of power tend to reinforce existing wealth hierarchies: poor and middle-income countries try desperately to move into more lucrative nodes through infrastructure development and trade deals, but upgrading opportunities are few and far between, and the global nature of production makes struggles by workers to improve conditions and wages extremely difficult.

Congolese coltan miners are separated from Nokia executives by more than an ocean — they are divided by history and politics, by their country's relationship to finance, and by decades-old development barriers, many of which are rooted in colonialism.

The smartphone value chain is a useful map of global exploitation, trade politics, uneven development, and logistical prowess, but the deeper significance of the device lies elsewhere. To discover the more subtle shifts in accumulation that are illustrated and facilitated by the smartphone, we must turn from the process by which people use machines to create phones to the process by which we use the phone itself as a machine.

Considering the phone as a machine is, in some respects, immediately intuitive. Indeed, the Chinese word for mobile phone is *shouji*, or "hand machine." People often use their hand machines as they would any other tool, particularly in the workplace. Neoliberal demands for flexible, mobile, networked workers make them essential.

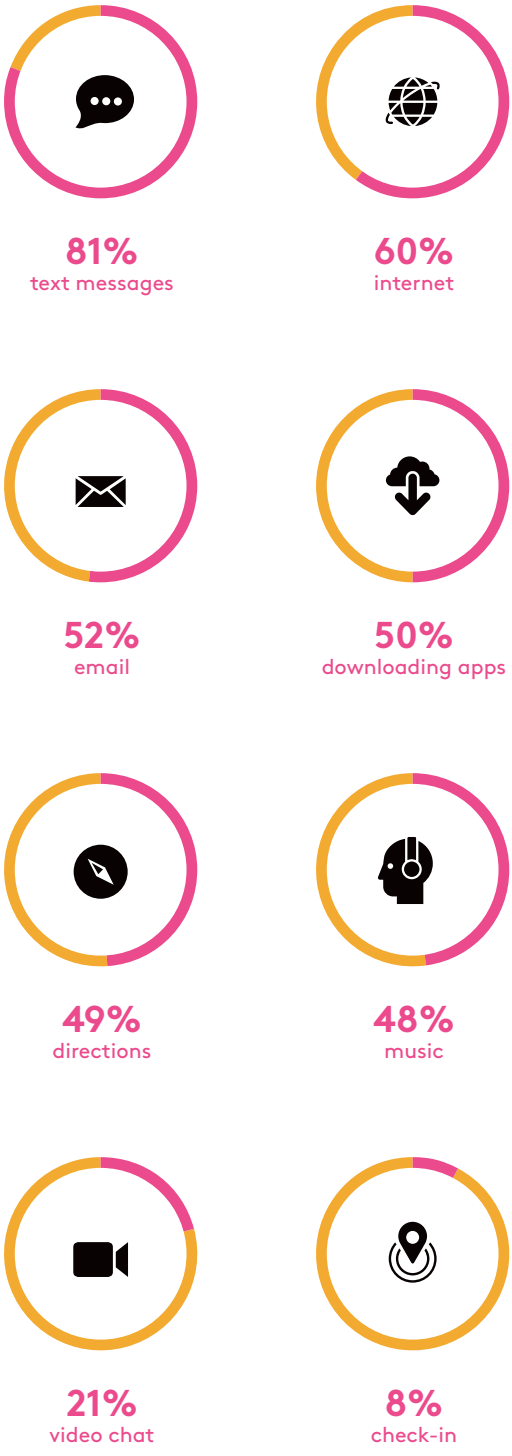
Smartphones extend the workplace in space and time. Emails can be answered at breakfast, specs reviewed on the train home, and the next day's meetings verified before lights out. The Internet becomes the place of work, with the office just a dot on the vast map of possible workspaces.

The extension of the working day through smartphones has become so ubiquitous and pernicious that labor groups are fighting back. In France, unions and tech businesses signed an agreement in April 2014 recognizing 250,000 tech workers' "right to disconnect" after a day's work, and Germany is currently contemplating legislation that would prohibit after-work emails and phone calls. German Labor Minister Andrea Nahles told a German newspaper that it is "indisputable that there is a connection between permanent availability and psychological diseases."

Smartphones have also facilitated the creation of new types of work and new ways of accessing labor markets. In the "marketplace for odd jobs," companies like TaskRabbit and Postmates have built their

Century of the Cell

Americans are using their phones for more than just talking.



business models by tapping into the "distributed workforce" through smartphones.

TaskRabbit connects people who would prefer to avoid the drudgery of doing their own chores with people desperate enough to do piecework odd jobs for pay. Those who want chores done, like the laundry or cleanup after their kid's birthday party, link up with "taskers" using TaskRabbit's mobile app. Taskers are expected to continuously monitor their phones for potential jobs (response time determines who gets a job); consumers can order or cancel a tasker on the go; and upon successfully completing the chore, the contractor can be paid directly through the phone.

Postmates — the darling of the gig economy — is an up-and-comer in the business world, especially after Lehmann pumped $16 million into it earlier this year. Postmates tracks its "couriers" in cities like Boston, San Francisco, and New York using a mobile app on their iPhones as they hustle to deliver artisanal tacos and sugar-free vanilla lattes to homes and offices. When a new job comes in, the app routes it to the closest courier, who must respond immediately and complete the task within an hour to get paid.

The couriers, who are not recognized employees of Postmates, are less enthusiastic than Lehmann. They get $3.75 per delivery plus tips, and because they're classified as independent contractors, are not protected by minimum wage laws.

In this way, our hand machines fit seamlessly into the modern world of work. The smartphone facilitates contingent employment models and

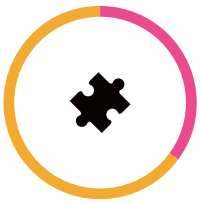
Source: Pew Research Center

There's an App for That

86% of smartphone owners have used their phones in the past month to…

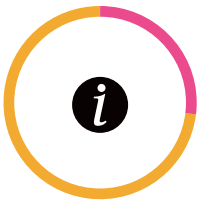
19%
get help in an emergency

41%
coordinate a meeting or get-together



35%
solve an unexpected problem

30%
decide whether to visit a business



27%
find information to help settle an argument

self-exploitation by linking workers to capitalists without the fixed costs and emotional investment of more traditional employment relations.

But smartphones are more than a piece of technology for wage work — they have become a part of our identity. When we use our phones to text friends and lovers, post comments on Facebook, or scroll through our Twitter feeds, we're not working — we're relaxing, we're having fun, we're creating. Yet, collectively, through these little acts, we end up producing something unique and valuable: our selves.

Selves for Sale

Erving Goffman, an influential American sociologist, was interested in the self and how individuals produce and perform their selves through social interaction. By his own admission, Goffman was a bit Shakespearean — for him "all the world is a stage." He argued that social interactions can be thought of as performances, and that people's performances vary depending on their audience.

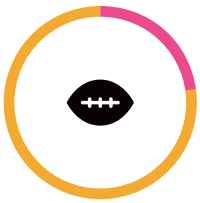
We enact these "front-stage" performances for people — acquaintances, coworkers, judgmental relatives — that we want to impress. Front-stage performances give the appearance that our actions "maintain and embody certain standards." They convince the audience that we really are who we say we are: a responsible, intelligent, moral human being.

But front-stage performances can be shaky and are often undermined by mistakes — people put their foot in their mouth, they misread social cues, they have a piece of spinach lodged in their teeth, or they get caught in a lie. Goffman was fascinated by how hard we work to perfect and maintain our front-stage performances and how often we fail at them.

Smartphones are a godsend for the dramaturgical aspects of life. They enable us to manage the impressions we make on others with control-freak precision. Instead of talking to each other, we can send text messages, planning our witticisms and avoidance strategies in advance. We can display our impeccable taste on Pinterest, superior parenting skills on CafeMom, and burgeoning artistic talents on Instagram, all in real time.

New York magazine recently ran a piece about the four most desirable people in New York City

20%
get traffic or public transit information



23%
look up a score of a sporting event

according to OKCupid. These individuals have crafted such attractive dating profiles that they are pummeled with attention and racy requests — their phones ping continually with messages from potential paramours. Tom, one of the chosen four, regularly tweaks his profile, subbing in new photos, and rewording his self-description. He has even used OKCupid's MyBestFace profile-optimizing service. Tom says all this effort is necessary in our present "culture of likes." Tom considers his OKCupid profile to be "an extension of himself": "I want it to look good and clean so, like, I make it do crunches and shit."

The incredible reach of social media and people's rapid adoption of it to produce and perform their selves are engendering the emergence of new technologically mediated rituals of interaction. Smartphones are now central to the way we "generate, maintain, repair, and renew as well as … contest or resist relationships."

Take texting rituals, which, with all their complex, unwritten rules, now play a commanding role in the relationship dynamics of most young adults. One need not deal in toxic nostalgia to admit that new, technologically mediated rituals are displacing or radically altering older conventions.

Digitally maintaining, generating, and contesting relationships through smartphones is somewhat different from using phones to complete tasks associated with wage work. Individuals don't get paid a wage for their Tinder profile or for uploading photos of their weekend adventures on Snapchat, but the selves and the rituals they produce are certainly for sale. Regardless of intention, when a person uses their smartphone to connect with people and the imagined digital community, the output of their labor of love is increasingly likely to be sold as a commodity.

Companies like Facebook are pioneers in the enclosure and sale of digital selves. In 2013, Facebook had 945 million users who accessed the site through their smartphones. It made 89 percent of its revenue that year from advertising, half of which came from mobile advertising. Its entire architecture is designed to guide the mobile production of selves through a platform that makes those selves salable. That's why it instituted its "real names" policy: "pretending to be anything or anyone isn't allowed." Facebook needs users to use legal names so it can easily match corporeal selves with digital selves, because data produced by and connected to an actual human is more profitable.

Users of the dating site OKCupid agree to a similar exchange: "data for a date." Third-party companies sit in the background of the site, scooping up users' photos, political and religious views, and even the David Foster Wallace novels they profess to love. The data are then sold to advertisers, who create targeted, personalized ads. The pool of people who have access to OKCupid's data is remarkably large — OkCupid, along with other companies like Match and Tinder, is owned by IAC/InterActiveCorp, the sixth-largest online network in the world. Crafting a self on OKCupid may or may not yield love, but it definitely yields corporate profits.

Awareness is spreading that our digital selves are now commodities. New School professor Laurel Ptak recently published a manifesto called "Wages for Facebook" and in March 2014, Paul Budnitz and Todd Berger created Ello, a fleetingly popular Facebook alternative. Ello proclaims: "We believe a

social network can be a tool for empowerment. Not a tool to deceive, coerce, and manipulate — but a place to connect, create, and celebrate life. You are not a product." Ello promises not to sell your data to third-party advertisers, at least for now. It reserves the right to do so in the future.

However, discussions of the peddling of digital selves by gray-market data companies and Silicon Valley giants are usually separate from conversations about increasingly exploitative working conditions or the burgeoning market for precarious, degrading work. But these are not separate phenomena — they are intricately linked, all pieces in the puzzle of modern capitalism.

iCommodify

Capital must reproduce itself and generate new sources of profit over time and space. It must constantly create and reinforce the separation between wage laborers and owners of capital, increase the value it extracts from workers, and colonize new spheres of social life to create commodities. The system, and the relationships that comprise it, are constantly in motion.

The expansion and reproduction of capital in everyday life and the colonization of new spheres of social life by capital are not always obvious. Thinking about the smartphone helps us put the pieces together because the device itself facilitates and undergirds new models of accumulation.

The evolution of work over the past three decades has been characterized by a number of trends — the lengthening of the workday and workweek, the decline of real wages, the reduction or elimination of non-wage protections from the market (like fixed pensions or health and safety regulations), the proliferation of part-time work, and the decline of unions. At the same time, norms regarding the organization of work have also shifted. Temporary, project-oriented employment models are proliferating. Employers are no longer expected to provide job security or regular hours, and employees no longer expect those things.

But the degradation of work is not a given. Increasing exploitation and immiseration are tendencies, not fixed outcomes ordained by the rules of capitalism. They are the result of battles lost by workers and won by capitalists. The ubiquitous use of smartphones to extend the workday and expand the market for shit jobs is a result of the weakness of both workers and working-class movements. The compulsion and willingness of increasing numbers of workers to engage with their employers through their phones normalizes and justifies the use of smartphones as a tool of exploitation, and solidifies constant availability as a requirement for earning a wage.

Apart from the Great Recession, corporate profit rates have steadily climbed since the late eighties, and not only as a result of capital (and the state) rolling back the gains of the labor movement. The reach of global markets has widened and deepened, and the development of new commodities has grown apace. The expansion and reproduction of capital is dependent on the development of these new commodities, many of which emerge from capital's incessant drive to enclose new spheres of social life for profit, or as political economist Massimo De Angelis says, to "put [these spheres] to work for [capital's] priorities and drives."

The smartphone is central to this process. It provides a physical mechanism to allow constant access to our digital selves and opens a nearly uncharted frontier of commodification.

Individuals don't get paid in wages for creating and maintaining digital selves — they get paid in the satisfaction of participating in rituals, and the control afforded them over their social interactions. They get paid in the feeling of floating in the vast virtual connectivity, even as their hand machines mediate social bonds, helping people imagine togetherness while keeping them separate as distinct productive entities. The voluntary nature of these new rituals does not make them any less important, or less profitable for capital.

Braverman said that "the capitalist finds in [the] infinitely malleable character of human labor the essential resource for the expansion of his capital." The last thirty years of innovation demonstrate the truth of this statement, and the phone has emerged as one of the primary mechanisms to activate, access, and channel the malleability of human labor.

Smartphones ensure that we are producing for more and more of our waking lives. They erase the boundary between work and leisure. Employers now have nearly unlimited access to their employees, and increasingly, holding even a low-paid, precarious job hinges on the ability to be always available and ready to work. At the same time, smartphones provide people constant mobile access to the digital commons and its gauzy ethos of connectivity, but only in exchange for their digital selves.

Smartphones blur the line between production and consumption, between the social and the economic, between the pre-capitalist and the capitalist, ensuring that whether one uses their phone for work or pleasure, the outcome is increasingly the same — profit for capitalists.

Does the arrival of the smartphone signify the Debordian moment in which the commodity has completed its "colonization of social life"? Is it true that not only is our relationship to commodities plain to see, but that "commodities are now *all* that there is to see?"

This might seem a bit heavy-handed. Accessing social networks and digital connectivity through mobile phones undoubtedly has liberatory elements. Smartphones can help battle anomie and promote a sense of ambient awareness, while at the same time making it easier for people to generate and maintain real relationships.

A shared connection through digital selves can also nourish resistance to the existing hierarchy of power whose internal mechanisms isolate and silence individuals. It's impossible to imagine the protests sparked by Ferguson and police brutality without smartphones and social media. And ultimately, most people are not yet compelled to use smartphones for work, and they certainly aren't required to perform their selves through technology. Most could throw their phones into the sea tomorrow if they wished.

But they won't. People love their hand machines. Communicating primarily through smartphones is fast becoming an accepted norm, and more and more rituals are becoming technologically mediated. Constant connection to the networks and information we call cyberspace is becoming central to identity. Why this is happening is a labyrinthine speculation. Is it, as media and technology expert Ken Hillis suggests, simply another way to "stave off the Void and the meaningless of existence?" Or, as novelist and professor Roxane Gay recently pondered, does our ability to manipulate our digital avatars provide a balm for our deep sense of impotence in the face of injustice and hate?

Or — as tech guru Amber Case wonders — are we all turning into cyborgs?

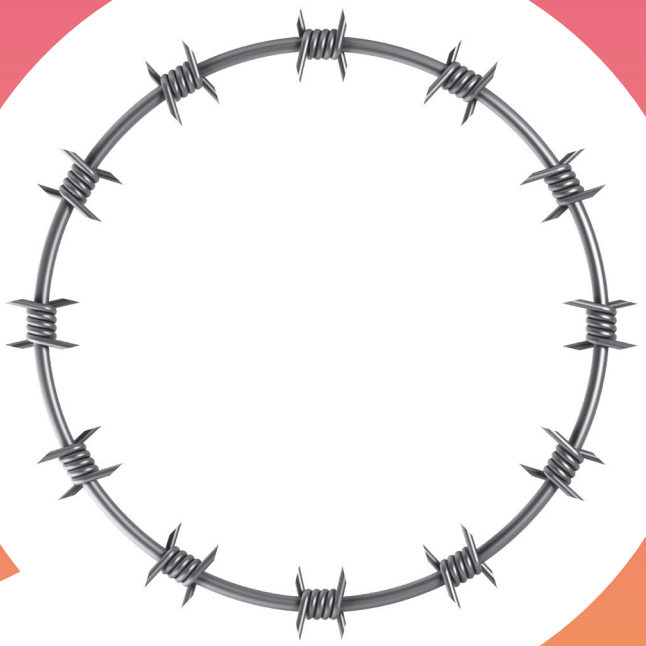
Probably not — but it depends on how you define cyborg. If a cyborg is a human who uses a piece of technology or a machine to restore lost functions or enhance her capacities and knowledge, then people have been cyborgs for a long time, and using a smartphone is no different than using a prosthetic arm, driving a car, or working on an assembly line.

If you define a cyborg society as one in which human relationships are mediated and shaped by technology, then our society certainly seems to meet this criterion, and our phones play a starring role. But our relationships and rituals have long been mediated by technology. The rise of massive urban centers — hubs of connectivity and innovation — would not have been possible without railroads and cars.

Machines, technology, networks, and information do not drive or organize society — people do. We make things and use things according to the existing web of social, economic, and political relationships and the balance of power.

The smartphone, and the way it shapes and reflects existing social relations, is no more metaphysical than the Ford Rangers that once rolled off the assembly line in Edison, New Jersey. The smartphone is both a machine and a commodity. Its production is a map of global power, logistics, and exploitation. Its use shapes and reflects the perpetual confrontation between the totalizing drives of capital and the resistance of the rest of us.

In the present moment, the need for capitalists to exploit and commodify is strengthened by the ways in which smartphones are produced and consumed, but capital's gains are never secure and unassailable. They must be renewed and defended at every step. We have the power to contest and deny capital's gains, and we should. Perhaps our phones will come in handy along the way. ■



Occupation Apps

New applications and mobile services for Palestinians are being called liberatory. But they're more a way for capitalists to profit from occupation.

Helga Tawil-Souri

Text "Q" to 37117 on a Jawwal mobile phone and you can get a brief update on the traffic conditions at the Qalandia checkpoint.

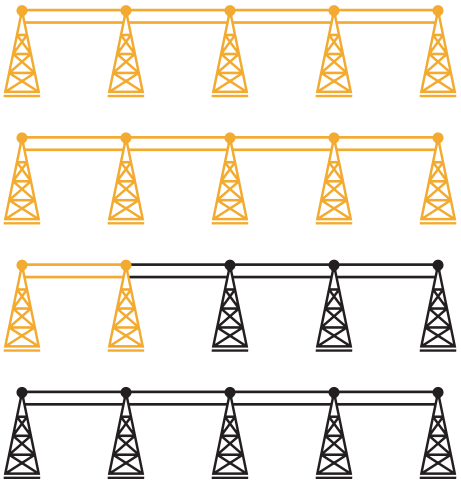
This sounds helpful enough, as Qalandia remains the busiest checkpoint in the West Bank, serving tens of thousands of Palestinians who must pass through it daily. The checkpoint was created in 2001, staffed 24/7 by the Israeli military starting in late 2002, and was redefined as a terminal in 2005.

As far as the military is concerned, the facility is a border crossing, which is obviously incongruous with the fact that Israel has yet to declare where any of its borders lie. Qalandia connects all of the central and northern West Bank — including cities like Ramallah and Nablus — to Jerusalem and other points in Israel. It does not, however, lie on any border. Qalandia sits on the Palestinian side of the Green Line, and separates Palestinians in the southern parts of the West Bank, in cities such as Bethlehem, Jericho, and Hebron, from areas farther north.

Qalandia forcefully deploys Israel's security technologies. Entering through barricaded walkways, passing through remote-controlled turnstiles, scanning magnetic ID cards through machines, displaying paperwork across a one-way mirror, and passing one's body and belongings through various detection machines: the interaction between Palestinian pedestrians and the Israeli military is almost entirely virtual and abstract. Communication takes place unidirectionally, over a loudspeaker.

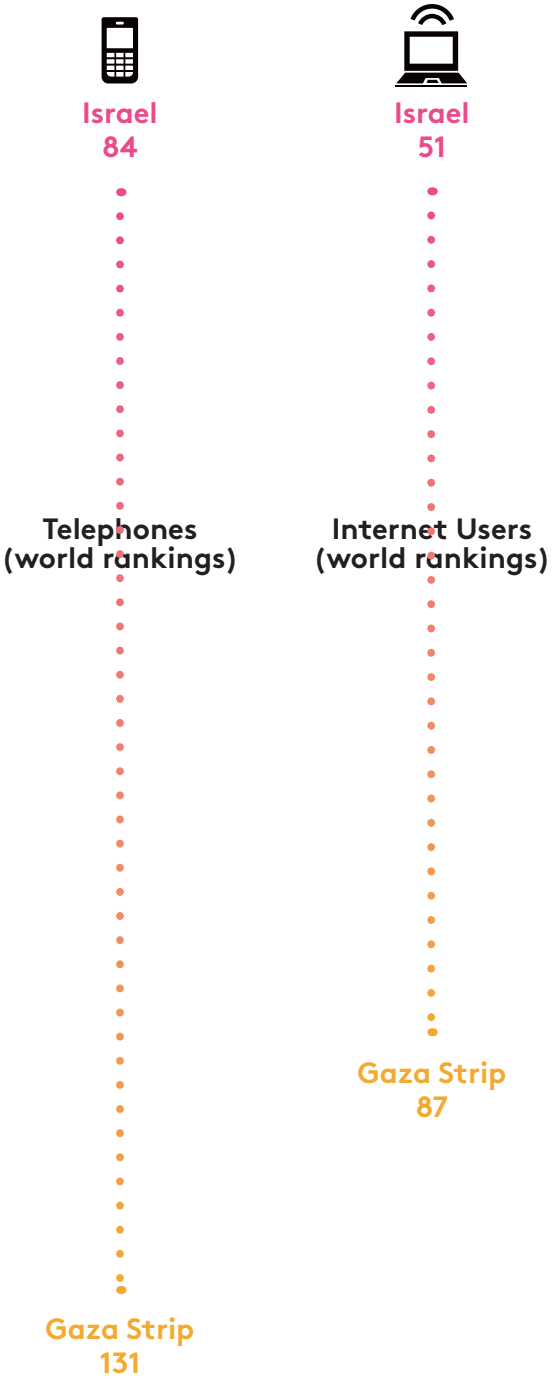
It is slightly more personal for those going through by bus or private car: between remote-controlled barricades, razor-wire fences, and

Apartheid and the Digital Divide



58% of Palestinians

rely on Paltel ADSL (copper phone line) home Internet connections since Israel limits 3G and 4G in the territories.



eight-foot-high metal doors built into the security barrier, there are opportunities to be questioned by soldiers, border patrol, police, and private guards. The orderliness of "security" is met by a chaotic environment of honking, cursing, fisticuffs, street merchants selling their wares, bodies (mostly male) pressed up against each other and against metal fences, dust, used plastic cups, layers and layers of graffiti, pieces of walls and barricades and fences, cigarette butts, and exhaust.

So it's helpful for Jawwal-equipped commuters to know whether it will take an hour or three to get through.

Technology pundits, entrepreneurs, and journalists praise technologies such as the Q service as liberatory for Palestinians. The Jawwal service is a latecomer to the game of mobile apps targeting Palestinians' mobility.

In 2010, a text messaging service called 'Ezma — Arabic for traffic jam —allowed cell phone users to send and receive messages about traffic conditions everywhere in the West Bank. An Uber-inspired application called Wasselni ("give me a ride" in Arabic) which allows people to find others to share a cab with, recently launched in the Gaza Strip. Q, offered by the first and largest Palestinian cellular

Sources: CIA World Factbook, Al Arabiya

provider, Jawwal (also the Arabic word for mobile phone), is simply targeting the niche market of the checkpoint. It is a relative latecomer to that market; a Facebook group called Qalandia Conditions, launched in early 2012, relies on community members to share their traffic experiences and allows members to post updates, pictures, videos, jokes, and frustrations.

There are technological and economic differences between these initiatives. 'Ezma is only available for cell phone users; Q only for those with a Jawwal phone. Wasselni is the outcome of Gaza Sky Geeks, an entity funded by various Western NGOs seeking to bolster the entrepreneurial tech spirit in the Gaza Strip. 'Ezma, a for-profit business, was born at a Start Up Weekend organized by the Peres Center for Peace, which prides itself on bringing Israeli entrepreneurs and programmers together with a few chosen Palestinians to come up with "joint" ventures. Qalandia Conditions is a grassroots effort which seeks neither funding nor revenue.

There is no denying that all of them demonstrate Palestinians' entrepreneurial spirit, reveal the wider diffusion of mobile technologies in society, speak to a desire for normalcy among Palestinians, and are examples of Palestinians' creative attempts to deal with Israel's control over their homeland.

Still, a text-message service created by Palestine's largest telecommunications provider in order to profit from the need to pass through an Israeli military checkpoint inside the West Bank symbolizes both the possibilities and limitations of technological and economic innovation under occupation.

Controlled Mobility

The Qalandia checkpoint itself is one of the most telling outcomes of the US-sponsored "peace" process. It emerged at the tail end of the five-year interim period between the 1995 Oslo II Accords and the Second Intifada in late 2000. It is located in Oslo-defined "Area C" — the 60 percent of the West Bank under full Israeli military control and joint Israeli and Palestinian Authority civil control.

Fourteen years after its inception, Qalandia today is a physical testament to the severing of Palestinian territory, the ongoing presence of the Israeli military, and the failure of a two-state solution.

The checkpoint also represents Israel's drive to "secure borders," understood as the creation of secure borders rather than an agreement on where borders are. The difference is not just geopolitical or semantic, but technological as well. Israel's success as a high-tech nation has been gained through the occupation. Its security-surveillance-military products and services — from unmanned aerial drones to walls, from gamma ray detectors to cyber-checkpoints — are marketed and sold as effective in combating terror, securing borders, and engaging in urban warfare or cyber-surveillance because they have been tested and proven in the field against Palestinians.

Qalandia is a "smart" border, decked out with the latest Israeli-made military technologies that perniciously demonstrate new techniques of surveillance and produce new kinds of borders and spaces of control. To be sure, spatial monitoring and population control have been central aspects of Israeli surveillance practices for decades. They are rooted in a history of governing subjugated populations in which the interaction between controller and controlled is increasingly mediated and abstracted, and where state violence shifts from direct infliction of bodily harm to concealed, sometimes "restrained" force. The checkpoint is not simply a moment of violence; it exists to disrupt everyday life. It is to this disruption that Q, Wasselni, 'Ezma, and others are responding.

Telecommunications, and especially cellular telephony, are also products of foreign-brokered "peace" processes. The second round of the Oslo Accords, signed in 1995, specified the terms of a possible independent and sovereign communications infrastructure: Palestinians could build their own telecommunications network, but everything about its infrastructure would ultimately remain under Israeli control. The Palestinian Authority sold the rights of telecommunications to the private sector, and the newly formed Paltel — and later its cellular subsidiary Jawwal — was billed as one of the first national firms. This rhetoric fit with various claims made by the PA, Israel, the US, and the EU that

national institutions would lead to a nation-state. The birth of Jawwal and Paltel also demonstrate the ideological hold of a neoliberal political economy which does not challenge Israel's economic power over Palestinians.

Israel maintained the power to determine what kind of equipment could be purchased, how much spectrum bandwidth would be provided, what area codes and access speeds would be allocated, how tall cellular and broadcasting transmission towers could be, and where infrastructure could be built, maintained, and accessed. The result was and continues to be a fractured infrastructure, limited in its technological capacity and dependent on the good graces of the occupation regime.

Israel's digital controls in the West Bank and the Gaza Strip parallel the occupation's materiality and provide a hint as to what Israel's geopolitical objectives for the two territories may be.

With respect to Gaza, the digital landscape parallels Israel's "disengagement." Since the settlements were removed in summer 2005, Israeli providers do not offer service in Gaza anymore. But the infrastructure remains dependent on Israel's: there is only one fiber-optic cable that connects the entirety of Gaza to the outside world, and it passes through and is controlled by Israel. All telephone calls within the Gaza Strip, whether on landlines or cellular phones, are switched on routers physically located within Israel. Internet speeds are capped by Israel's Ministry of Communications. The list of limitations goes on.

Since 2005, the Israeli military has also taken the liberty of bombing and destroying much of the Palestinian infrastructure. As demonstrated in the last military blitzes over Gaza, the fact that the Israeli military can interrupt signals, pinpoint the location of beaming signals, call specific numbers in any given location to "warn" of an impending bomb, and slow or halt Internet access is due to the fact that the entirety of the infrastructure is under Israeli control.

Compared to the Gaza Strip, the West Bank's digital landscape is more fractured. Palestinians were given permission to build their own infrastructure in Area A and some of Area B, but always with strict limitations as to the kinds of technologies permissible. Only once, after years of negotiation, did Israel give permission to the Palestinians to erect a cellular antenna in Area C, for example.

As in Gaza, all West Bank telephone and Internet lines ultimately connect through Israeli routers for which Palestinian companies pay higher prices — called "termination charges" — than their Israeli counterparts. Jawwal was given spectrum allocation by the Israeli Ministry of Communications in 1998 to support 120,000 subscribers on a 1.5G network. Today, Jawwal boasts more than 2.5 million cellular users, but the infrastructural capacity of its network remains that of 120,000.

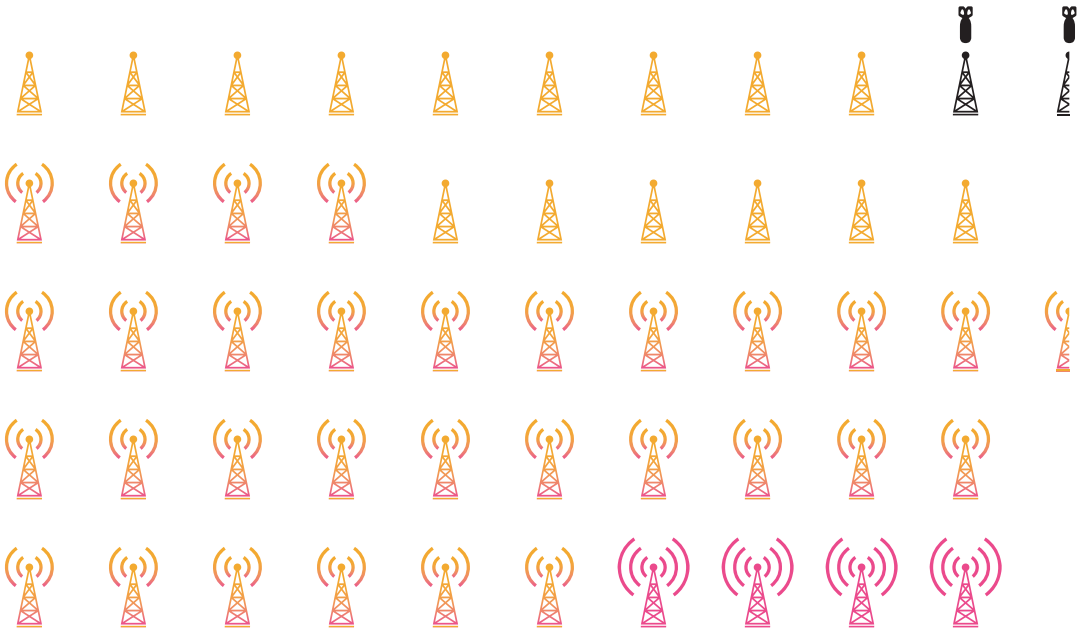
The overburdened network is operating on technologies more than fifteen years old: 2G and 3G are not permitted, which means that new mobile services such as financial applications (PayPal, online banking), mapping, and GPS are nonexistent. Pushed by the World Bank to liberalize its cellular market, the PA agreed in 2006 to allow a second cellular provider to operate in the Territories. Wataniya negotiated with Israeli ministries for more than four years before it obtained spectrum allocation to operate in the West Bank, and only after Tony Blair's involvement in his capacity as the Quartet's Special Envoy was Wataniya eventually provided just enough spectrum to launch a basic 2G network. It is still waiting for permission to operate in the Gaza Strip.

There are numerous ways in which Israel holds back Palestinian telecommunications development, but spectrum allocation epitomizes the extent to which the underlying structure of Palestinian digital development has been stunted from its inception. Neither cellular telephony, nor Wi-Fi, nor ambulance and police communications, for example, can exist without spectrum. Allocation must be adjusted for every new technology, from microwaves to handheld GPS devices. Spectrum allocation is also used as a negotiating tool: every time the Palestinian Authority has threatened moving forward with its International Criminal Court application, for example, Israel withholds the release of bandwidth.

Bandwidth is not an unlimited resource, but claims that Israel does not have enough to share with Palestinians are technologically erroneous. What

Communication Breakdown

The impact of the summer 2014 attacks on Palestinian infrastructure.



12
stations damaged by Israeli bombs

120
stopped due to fuel shortage

32
stations fully operational

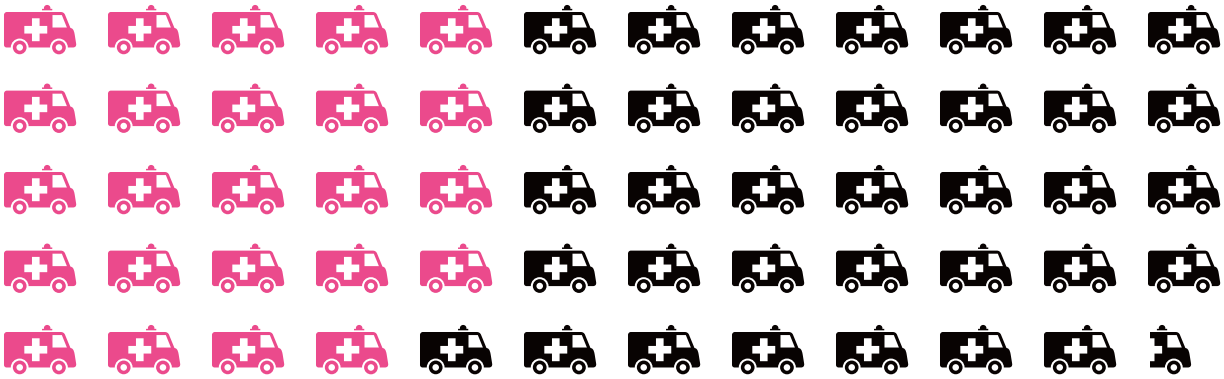
does pose a bandwidth "problem" is that the four Israeli commercial cellular firms service almost the entirety of the West Bank. In settlements, outposts, bypass roads, military installations, military-defined buffer zones, and locations all along the wall, among others, Israeli cellular towers beam strong signals (Israeli firms enjoy two thousand times more spectrum allocation than Jawwal and Wataniya combined, and are permitted to use all of the latest technologies more cheaply). In other words, from the depths of Ramallah and Nablus to the entirety of Area C, including the Qalandia checkpoint, one can receive signals from Pelephone, Cellcom, and Orange — the three largest Israeli cellular firms.

While the Israeli companies operate under the guise of providing service to settlers and the military, they also profit handsomely from the "no-cost" market of Palestinians. No extra investment is necessary to sell service to Palestinians, whether they purchase Israeli phones directly or by "roaming" on Israeli networks.

Roaming connotes movement across different (and arguably sovereign) spaces. It means you are no longer on your provider's infrastructure but moving into another provider's space, where service can only work if this provider has infrastructure and if your provider has an agreement to use the network. In 2005, Jawwal and one of the Israeli providers, Orange, agreed that Jawwal could pay for and sell roaming privileges to its users, and thus "opened" access to much of the West Bank. In the meantime, the Israeli providers do not pay any taxes to the PA — as agreed in Oslo — for operating in Area C and much of Areas A and B. It's a captive market in every sense of the word.

Source: Middle East Eye

Dead on Arrival



41%

of the 591 ambulance transfers to East Jerusalem conducted by Red Crescent Society were able to proceed directly between January and May 2012.

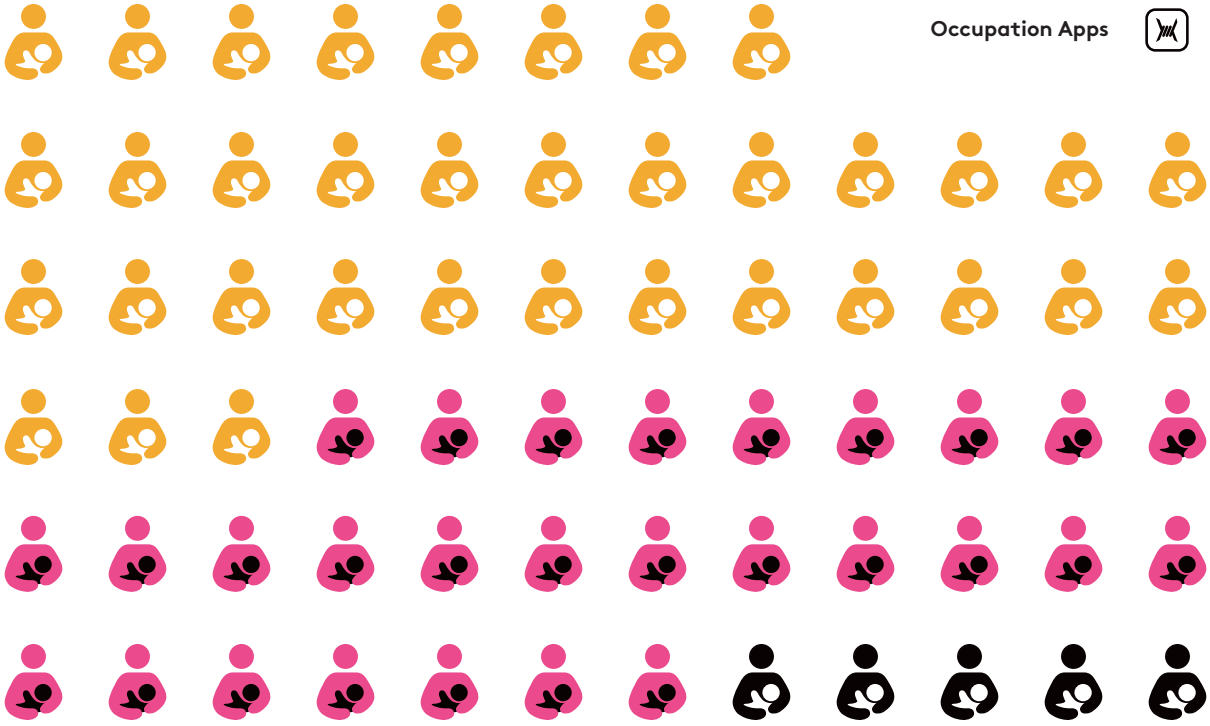
At the same time, entities such as the World Bank, the EU, and USAID continue to pressure Palestinians to liberalize their markets and open cellular telephony (among other industries) to foreign competition without tackling illegal Israeli competition or the underlying structures of uneven economic conditions.

For years, there was simply no telephone service in and around Qalandia. Given its location in Area C, the largest transportation hub in the West Bank is not part of the Palestinian telecommunications grid. Nearby Jawwal signals are not strong enough to reach the checkpoint, and Jawwal has no permission to build there. Only in the last few years have Israeli signals from nearby settlements become strong enough to reach the checkpoint. The ability to text Q on your Jawwal phone or to check in on the Facebook page requires you to use and pay for Israeli signals.

Jawwal's Q service, 'Ezma, Qalandia conditions, and others are all outcomes of Palestinians' fragmented space and attempts to deal with the reality that Palestinian mobility is stunted. The for-profit examples are always supported, often behind the scenes, by foreign interests pushing to liberalize markets, increase Palestinian purchasing of European and American equipment, or support technological entrepreneurship. Ironically, each of these examples speaks to a geographic need, and yet not a single one of them can offer, for example, mapping services. In other countries there is no need for Facebook groups or text-message services to gauge traffic, not only because there are no checkpoints, but because people have access to Google Maps, GPS navigation systems, or things like Waze, a community-based navigation and traffic application created in Israel.

Telecommunications permits Palestinians to communicate with each other and the world beyond their walls. It is an important aspect of Palestinian economic development and growth. In fact, the parent company Paltel contributes to at least 10 percent of the West Bank and Gaza's GDP and 30 percent of the PA's tax revenue. But telecommunications is equally a means through which Israeli occupation continues — in dynamic and changing ways — as a form of control and surveillance. And, as Jawwal's Q service and the Qalandia Conditions Facebook group both demonstrate, telecommunications ends

Source: United Nations



From 2000 to 2007 at least 68 women gave birth at checkpoints. 35 miscarriages 5 dead

up depending on the very conditions of spatial enclosure it attempts to negate. Jawwal and others seeking to profit from Palestinian imprisonment is representative of the modern political-economic conditions of the occupation.

There is nothing revolutionary about services that help you gauge traffic through a checkpoint: they only exist because of the checkpoint and Palestinian oppression. The Q service is also a testament to the field of economic possibility: profits are made on aspects of life dependent on and made desperate by the occupation. Israeli firms are the ultimate profit-makers. Neither the NGO-driven for-profit startups nor the nonprofits challenge the macro structure of Israeli occupation, territorial expansion, and technological and economic superiority that relies on Palestinian containment and de-development.

This matrix has only deepened since the beginnings of the Oslo Accords and the various subsequent promises of peace supported by the US and the EU. The agreements established a customs union resulting in an absence of economic borders and thus preserved the uneven economic relations that already existed. Given this, most projects, whether for profit or not, never challenge the idea of a weak Palestinian economy integrated with and dependent on the Israeli economy.

Getting Where?

It's been at least an hour since you first arrived; you have inhaled more than your fair share of carbon monoxide and dust. You have cursed every mother, father, and child passing by. It will still take you another half hour to get to the soldier, who may well force you to turn back without telling you why.

You text "Q" to 37117 on your Jawwal and receive a message that traffic is "light" today. Conditions are "normal." You incur an SMS charge on your outdated phone, as well as a roaming fee. You can't call your spouse to let them know you are late because as you inch your way to the checkpoint, the signal disappears. You consider yourself lucky because your colleague who decided to take two cabs (one on each side) and pass through the terminal on foot is stuck in the remote-controlled turnstile. Poor bastard. Maybe he should have stayed home. ■

Edutopia

Education is not a design problem with a technical solution. It's a social and political project neoliberals want to innovate away.

Megan Erickson

At a recent professional development training, I was told to imagine what kind of school I would design if I had five million dollars. I scribbled down a few ideas, shared them with the group, and was then asked to consider how I could implement them now, without the money.

The point was this: forget the cash. Forget that American teachers spend an average of $500 a year supplying their classrooms with materials. Anything is possible, if you put your mind to it.

Similarly, *Design Thinking for Educators,* the eighty-one page "design toolkit" made available to teachers as a free download by New York City-based firm IDEO — which has designed cafeterias for the San Francisco Unified School District, turned libraries into "learning labs" for the Gates Foundation, and developed a marketing plan for the for-profit online Capella University — contains no physical tools. Problems ranging from "I just can't get my students to pay attention" to "Students come to school hungry and can't focus on work" are defined by the organization as opportunities for design in disguise.

Tim Brown, IDEO's CEO and a regular at Davos and TED talks, has described design thinking as a way to inject "local, collaborative, participatory" planning into the development of products, organizational processes, and now schools. *Design Thinking for Educators* is full of strikingly drawn graphic organizers and questions like, "How might we create a twenty-first century learning experience at school?" with single paragraph answers. "Responsibility" is used three times in the text, always in reference to teachers' need to brainstorm fixes for problems together and develop "an evolved perspective." (The word "funding" is not used at all — nor is the word "demand.")

We're told faculty at one school embarked on a "design journey" and came to an approach they call "Investigative Learning," which addresses students "not as receivers of information, but as shapers of knowledge," without further detail on how exactly this was accomplished.

Of course, the idea of engaging students as experienced co-teachers in their own education isn't novel, nor is it an innovation that sprang forth from a single group of teachers using graphic organizers to brainstorm and chart solutions. Marxist educator Paulo Freire developed his critique of the "banking model" of education — in which students' minds are regarded as passive receptacles for teachers to toss facts into like coins — while teaching poor Brazilian adults how to read in the 1960s and '70s. His book, *Pedagogy of the Oppressed*, helped reignite the progressive education movement during that era, and his collaborative approach to learning remains influential in American schools of education today.

Peter McLaren, who taught elementary and middle school in a public housing complex for five years before becoming a professor of education, has since further developed Freire's ideas into an extensive body of revolutionary critical pedagogy, which I was assigned in my first class as a master's student in education. The Radical Math project, launched a decade ago by a Brooklyn high school teacher whose school was located within a thousand feet of a toxic waste facility, draws heavily on Freire's perspective in its curriculum for integrating social and economic justice into mathematics.

Yet, here we are, a "nation at risk," with lower test scores than our international peers and children still arriving at school every day without breakfast.

Like all modern managerial philosophies that stake their name on innovation, "design thinking" has been framed by creative-class acolytes as a new way to solve old, persistent challenges — but its ideas are not actually new. According to Tim Brown, design thinkers start with human need and move on to learning by making, "instead of thinking about what to build, building in order to think." Their prototypes, he says, "speed up the process of innovation, because it is only when we put our ideas out into the world that we really start to understand their strengths and weakness. And the faster we do that, the faster our ideas evolve."

What design thinking ultimately offers is not evolution, but the look and feel of progress — great graphics, aesthetically interesting configurations of furniture and space — paired with the familiar, gratifying illusion of efficiency. If structural and institutional problems can be solved through nothing more than brainstorming, then it's possible for macro-level inputs (textbooks, teacher salaries) to remain the same, while outputs (test scores, customer service) improve. From the perspective of capitalism, this is the only alchemy that matters.

Design Thinking for Educators urges teachers to be optimistic without saying why, and to simply believe the future will be better. The toolkit instructs teachers to have an "abundance mentality," as if problem-solving is a habit of mind. "Why not start with 'What if?' instead of 'What's wrong?'" they ask.

There are many reasons to start with "What's wrong?" That question is, after all, the basis of critical thought. Belief in a better future feels wonderful if you can swing it, but it is passive, irrelevant, and inert without analysis about how to get there. The only people who benefit from the "build now, think later" strategy are those who are empowered by the social relations of the present.

The same people benefit when analysis is abandoned in favor of technical solutions — when the long history of education for liberation, from Freire to the SNCC Freedom Schools to Black Panther schools to today's Radical Math and Algebra projects (none of them perfect, all of them instructive) is ignored.

It's not surprising, then, that when Carlos Rodríguez-Pastor Persivale, the billionaire son of an elite Peruvian banking family, decided to expand his empire of restaurants and movie theaters by buying up a chain of for-profit English-language elementary schools, his first step was to contact IDEO and commission them to design everything: the buildings, the budget, the curriculum, professional development opportunities for teachers. The network is called Innova, and it's on its way to becoming the largest private school system in Peru.

According to "ed tech community" edSurge, Innova is "more than just an example of how first-world ideas about blended learning and design thinking can be adapted in a developing country." It aims to close the achievement gap, build Peru's next generation of leaders, "and make a profit while doing so."

Innova students use computer tutoring programs designed by Pearson and Sal Khan, a Gates

From Chalkboards to Smartboards

For more than three centuries, the education field has been the scene of technological innovations, some more useful than others.

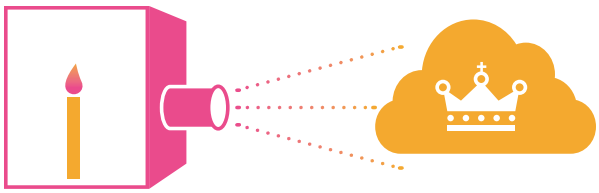
1650

Wooden paddles with printed lessons called "hornbooks" are popular throughout the colonial era.

Foundation protégé. (By now, Khan's story is canonical among readers of the *Harvard Business Review*: in 2005, the former hedge-fund analyst created a simple computer program for practicing math problems and some instructional videos to help tutor his cousins remotely. These went viral on YouTube among parents looking for after-school enrichment activities for their children, including Bill Gates.) In a photograph of one location posted to IDEO's website, students sit in groups of six, each absorbed in his or her laptop. The school's modular walls collapse to allow classes of thirty to be joined together into one large group of sixty students at various times throughout the day.

After a visit, Khan remarked, "I was blown away when I visited Innova. It was beautiful, open, and modern. It was inspiring to see an affordable school deliver an education that would rival schools in the richest countries." The question is, affordable for whom?

Tuition at an Innova school is $130 a month, which is considerably less than the cost of your average American private school, but would require shelling out over a quarter of the monthly income of a family living on Peru's median household income of $430 a month. Half of the families that attend Innova are led by two parents working professional jobs such as accountants, engineers, or entrepreneurs. For his part, Rodríguez-Pastor has been clear that the schools are targeted specifically at Peru's emerging middle class, but



1793

Seance-master Paul Philidor arrested in Paris for using an early laterna magica — the predecessor of the slide machine — to depict Robespierre as the devil and the rise of Louis XVI into heaven.

1890

Chalkboard popularized.

1905

Keystone View Company begins marketing stereoscopes with educational sets containing hundreds of images to schools.

American education reformers have a different sense of what the schools represent.

IDEO puts forth the fact that Innova students perform higher than the national average on math and communication tests as proof that they've delivered on their mantra for the project: "affordability, scalability, excellence." But if test scores are higher than those of public schools, it is not because of the soul-searching of teacher/designers. It's because tuition is about a quarter of the national median income. After all, a consistent pattern in the educational research of the past half-century is that the socioeconomic status of a child's parents is one of the strongest predictors of his or her academic success.

"Usually in Peru, our schools are like a jail," says Innova founder Yzusqui Chessman. "But [Innova] schools … have big transparency, many colors, and bandwidth throughout." Transparency and Wi-Fi for the middle class, while everyone else attends jail-like schools?

Given the data, perhaps it would be more revolutionary, more innovative — more forward-thinking — if, instead of free idea toolkits, IDEO built a system that ensured that every child, rich and poor, had access to these beautiful new schools. There is one simple, elegant solution: make them free and public, and tax rich business owners like Rodríguez-Pastor to pay for them.

On the other hand, American historian of education Larry Cuban has observed that even when innovations *are* well-funded for mass use in public schools — during the Baby Boom, for instance, over $100 million was invested by the federal government and the Ford Foundation to promote the use of televisions in classrooms to alleviate a teacher shortage — they rarely change the fundamental nature of schooling. When we think about the classrooms of the future, we have to ask what (as Marshall McLuhan has put it) technologies like radio and television can do that the present classroom can't. That means asking: what's futuristic about the future? And equally important, whom will it belong to?

Teaching Machines

Technology offers real possibilities for positively changing the way we relate to each other as human beings. For example, adaptive technology for children with special needs gives us the potential to integrate even children with severe disabilities into general-education classrooms. But one laptop per child can't lift communities out of poverty, because technology is not an alternative to wealth redistribution from the top 1 percent to the bottom 99. There is a disconnect between what we imagine technology and education can do, and what they actually do.

Management gurus and their tech-industry followers insist that if we can dream it, we can do it; that instead of "throwing more money at the problem," we must use our creativity to brainstorm best practices for education and make them scalable. Harvard Business School Professor Clayton Christensen believes that in the future, computer-based instruction will entirely replace the current model, bringing a higher return on investment for the nation's education system.

Today's corporate education reformers express frustration with the continuity of traditional schooling methods — though most do not recognize the history to which they are intimately tied, since technological innovation is imagined to be as ahistorical as it is apolitical. In a 2013 Google+ hangout, US Secretary of Education Arne Duncan told Sal Khan:

> We have to continue to accelerate. The fact that we're still teaching with a nineteenth-century model makes no sense whatsoever, with twenty-five or thirty kids sitting in rows learning the same thing at the same time, same pace. It's like Neanderthal. It makes no sense. This idea with technology being a great thing to empower moving from seat time to competency — I don't want to know how long you sat there, I want to know, do you know the materials? Do you know Algebra or Biology or Chemistry or Physics? If you know it, you shouldn't have to sit there.

Edward Thorndike, the behavioral psychologist known for introducing scientific methods into the field of education, shared this frustration when he first theorized the possibility of a teaching machine. Textbooks, he observed in 1912, prod a student towards reasoning, but are unable to manage

the process of elucidating just enough to help a student arrive at his or her own conclusions.

Described by colleagues as prodigious, efficient, and an extremely rapid reader who liked to read books in one sitting, smoking cigarettes between chapters, Thorndike was preoccupied throughout his career with the quantification of human intelligence — he would go on to create an aptitude test used by the American military during World War I, as well as college entrance exams — but his objection to the use of textbooks in classrooms is an argument against standardization, or at least, against learning at a single standard pace mediated by a teacher.

Thorndike envisioned a future in which texts were capable of offering a self-directed learning experience for schoolchildren: if, "by a miracle of mechanical ingenuity," he wrote, a book could be arranged to hide information and display it step-by-step, so that page two was only accessible upon mastery of page one, "much that now requires personal instruction could be managed by print" — effectively making the teacher-as-guide obsolete.

Four decades later, B. F. Skinner, a man who neither believed in free will nor had hope for the world's salvation, stood in front of a new kind of classroom and announced that the future was here. Skinner had been influenced by the work of Sidney Pressey, a psychologist who, following Thorndike's research on the retention of information through practice, developed a machine he believed would generate an industrial revolution in education (Pressey himself was deterred by the Great Depression).

"I am B. F. Skinner, Professor of Psychology at Harvard University. I should like to discuss some of the reasons why studying with a teaching machine is often dramatically effective," he announces in a video from 1954. On the screen, we see an enormous group of teenage children sitting elbow-to-elbow at long tables, rapidly and silently inputting answers into a device that looks like a cross between a typewriter and a record player. In the window of each child's machine is an incomplete sentence or an equation missing a piece. Once the student fills in the blanks, the

1925

NYC's Board of Education begins using the radio to broadcast lessons to schools, starting a two-decade tradition of "schools of the air" that would reach millions of American students.

1930

Overhead Projector: used first by the US military to train forces in WWII, it eventually spread to schools.

1940

Mimeograph: produced copies through a hand-crank mechanism.

1950

Language-lab headset: schools begin to install cubicles with headsets and audio tapes.

machine confirms or corrects the answer. Every child works alone. "The machine you have just seen in use… is a great improvement over the system in which papers are corrected by a teacher where the student must wait perhaps until another day to learn whether or not what he has written is right. Such immediate knowledge … most rapidly [leads to] the formation of correct behavior," Skinner reflects.

Skinner was not only concerned with increasing the efficiency of knowledge absorption for the individual learner, but also for the group. He leaves us with this: "With techniques in which a whole class is forced to move forward together, the bright student wastes time waiting for the others to catch up, and the slow student, who may not be inferior in any other respect, is forced to go too fast … A student who is learning by machine moves at the rate that is most effective for him."

For Skinner, as well as for corporate education reformers, knowledge is static and students are passive recipients; efficient transmission of information is the goal of education. And technology is the means by which we make the transmission process faster, cheaper, smarter. Gifted children are best served by moving individually at their own pace, "slow students" move at theirs, all in isolation. This way of conceptualizing learning corresponds neatly with our present economic system, in which individuals either stand or fall on their merits, but it fails to deal with — in fact it conceals — the contentiousness of reality.

Skinner's new classroom went through many iterations over the decades that followed. A more sophisticated version known as Individually Prescribed Instruction (IPI) was used by students at Pittsburgh's Oakleaf Elementary in 1965, and described by a contemporary journal of education as "the nation's first successful operation of individualized instruction on a systematic, step-by-step basis." His teaching machine, however, was never adopted on a mass scale in American public schools.

Part of the resistance to the technology came from educators. Newly professionalized, they were adamantly opposed to having their role transformed into that of a coordinator. Rodney Tillman, Dean of the George Washington University School of Education, wrote in an essay titled simply "Do Schools Need IPI? No!" that the functions of a teacher using the system are limited to "writing prescriptions for courses of study, diagnosing student difficulties, and tutoring … These I cannot accept."

Tillman was not resistant to the use of technology in schools so much as he was hostile to the particular vision of learning implicit in teaching machines, which rewarded rote mastery while evaluating student performance in isolation. The skills required to prepare children for the future were, he argued, not didactic, but interpersonal.

And even in neurotic post-Sputnik America, parents tended to share a belief in the broadly humanist model of education. In 1960, the National Education Association (NEA) found it necessary to release a statement reassuring concerned mothers that while mechanical aids were now part of a modern classroom, they would never be the mode of instruction. "NEA Allays Parent Fears on Robot Teacher" was the headline in the *Oakland Tribune*.

Anxiety about technology in classrooms, or about robots raising the children, was crystallized in pop culture. *The Jetsons*, which premiered in 1962, is the story of a typical nuclear family in the year 2062. George Jetson works a few hours a week at Spacely's Space Sprockets, Jane Jetson is a homemaker, and young Elroy Jetson's teacher is a robot named Ms Brainmocker.

By 1981, at the end of his life, Skinner recanted his belief that technology could solve the world's problems, observing bitterly that no one had had the inclination to use the tools he'd created. Skinner was not alone in his desire to radically transform education for a new century, or in his eventual disillusionment with this project. Just a few decades prior to the development of the teaching machine, Thomas Edison had declared that books were obsolete and motion pictures would initiate a revolution of the school system within ten years — a process that is still dramatically incomplete over a hundred years later.

The possibilities of education technology remain ambiguous. The tools with which we learn are neither intrinsically empowering, as Skinner assumed and Arne Duncan continues to assume, or inherently threatening. They can be used in ways that are liberating or oppressive. But the popular

idea that technological innovation is cruel (Ms Brainmocker) is not irrational.

"Innovation" is almost always invoked by elites to ignore class conflict, to the point that some leftists have come to be wrongly but understandably suspicious of modernization altogether. Experts from Edison onward called enthusiastically for the incorporation of film and radio in classrooms without accounting for the fact that, as historian David Tyack points out, there were still tens of thousands of American schools that lacked electricity well into the 1960s. Of course, these schools were not evenly distributed across the country. They were the ones attended by working-class children, particularly in communities of color.

The Optimism of Billionaires

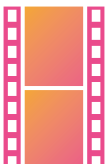
In 1966, an MIT professor lamented that it had been easier to put a man on the moon than to reform public schools. Today, SpaceX CEO Elon Musk wants to replace the US space shuttle program and blow up education by turning it into a game and adding special effects.

"Give kids a chance to fly," Duncan said to Khan in their Google hangout. "Let them find their passion and they'll go to the moon with that." Why are two such disparate concepts as education and space travel so intricately linked in our public discourse? Education and space are both metonyms for the future. When today's children grow into tomorrow's adults, holding meetings in holodecks and beaming themselves through the galaxy in maroon turtlenecks, they will have replaced us. When science fiction becomes reality, we will all be dead, unless we figure out a way to bring about the impossible.

From the perspective of the tech industry, education and space travel are alike because they are problems in search of rational, personalized, twenty-first century answers, like those arrived at by design thinking. The expectation is that these answers will obliterate material limitations, class struggle — history, past and present. Design thinking, embraced by key figures in business and especially in the tech industry, insists that

1960

Secretary Bette Nesmith Graham invents "whiteout" in response to the introduction of electric typewriters in her workplace. By 1977, her company was mass-producing the fluid and selling 500 bottles a minute. She would later sell Liquid Paper to Gillette for nearly $50 million.



1965

Filmstrip viewer popularized.

1972

The Scantron Corporation begins producing a machine for streamlining the grading of multiple-choice exams. From 2010 to 2012, the company was a member of the American Legislative Exchange Council. The ALEC Education Task Force included institutions connected to the Koch brothers and conservative think tanks.

1977

Apple introduces 8-bit computer Apple, which quickly becomes popular in schools.

educators adopt a perpetually optimistic attitude because that is what it takes to believe everything will turn out okay if we just work together to streamline our efforts. That is what it takes to believe that the best idea is the one that survives group discussion and is adopted. The rabid optimism of the techno-utopian vernacular, with its metaphors that no longer register as metaphors, obscures the market imperatives behind the industry's vision for the future.

This is intentional. Conflating the future with unambiguous, universal progress puts us all on equal footing. Participating as a citizen in this framework consists of donating your dollar, tweeting your support, wearing your wristband, vowing not to be complacent. Critiquing the solution only impedes the eventual discovery of the solution. And why make demands for power if you yourself are empowered? Empowerment, as Duncan uses it, is a euphemism. Anger is empowering, frustration is empowering, critique is empowering. Competence is not empowering.

The fact is, education is not a design problem with a technical solution. It is nothing like building a spaceship. It is a social and political project that the neoliberal imagination insists on innovating out of existence. The most significant challenges faced today in education are not natural obstacles to be overcome by increasing productivity — they are man-made struggles over how resources are allocated.

In a frequently cited policy report on academic performance and spending over the past forty years, Andrew J. Coulson of the Cato Institute concludes that dramatic increases in education funding have not resulted in improvements in student performance. "In virtually every other field," Coulson notes, "productivity has risen over this period thanks to the adoption of countless technological advances — advances that, in many cases, would seem ideally suited to facilitating learning. And yet, surrounded by this torrent of progress, education has remained anchored to the riverbed, watching the rest of the world push past it." What Coulson and others who repeat this myth ignore is who specifically is left out of the tech world's ecstatic march towards progress, and how and why they are left out.

The United States is one of just three OECD countries, along with Israel and Turkey, where schools that serve rich families have better resources and more funding than schools that serve poor families. The other thirty-four countries included in the index either provide equal funding for all students or spend a disproportionate amount of money on students from low-income families.

In a country where the top 20 percent of the population earns eight times as much as the bottom 20 percent, this inevitably leads to two distinct and parallel systems of education, one for the rich and one for the poor. It's not that "money doesn't matter" for reforming the education system, or that technology can be a substitute, but that children from working-class and poor families score lower on standardized test scores than their wealthy peers — and America has many more poor families than rich.

The Cynicism of Managers

Sal Khan's Khan Academy, funded by generous grants from the Gates Foundation, is the miracle of mechanical ingenuity that Thorndike dreamed of a century ago. When I first logged on to Khan Academy, I was surprised to find that despite all the tech-industry backing, it is not attractive, simple, or intuitive. Users mouse over the Subjects bar and choose Math, Science, Economics and Finance, Arts and Humanities, Computing, Test Prep, or Partner Content. Clicking on a Math "mission" brings you to a page of basic exercises. In instructional videos, Khan is awkward, a one-time mathlete with a slight twang and the affected exuberance of someone who has been teased but ultimately rewarded for being himself.

The website is interactive in the most mechanistic sense of the word: it provides individual feedback. After ten correct answers, the user can move on to the next concept. Ten correct answers is applied uniformly throughout the site as a metric, though it's unclear why success in this metric indicates mastery, just as the 85 percent correct required by the IPI system seemed to be arbitrarily selected in order to enable the teaching machine to function. Badges, which are meant to be incentives, are exactly

the kind of thing an "unabashedly geeky" adult would think a kid might find interesting.

It is a cloud-based, portable version of Skinner's teaching machine. Its strength is that it is self-guided: exercises allow repetition and provide students with immediate feedback as they practice. Memory performance improves with practice, and practice leads to automaticity, which frees up working memory and allows us to concentrate on comprehension. That's why it's impossible to gain complex insight into the abstract concepts of literature or algebra until we can read words and equations fluently. Passive practice does not actually improve our recall of information, and Thorndike, who saw the mind as a group of habits, was the first to identify the use of feedback as essential to successful learning.

But where's the revolution? Khan is quick to say his videos are not a replacement for teachers, a claim that seems disingenuous given that the mission of his project is to "provide a free world-class education for anyone, anywhere." Pedagogically, the videos are unambitious. Even with a paper textbook, a student can move at his or her own pace and receive feedback by checking answers at the back of the book. Why should a digitized version create a significantly different outcome?

Khan Academy is a fine way to practice math problems or learn a didactic skill. What it is not is innovative in pedagogy or design. As a system of education it is a failure. It degrades both student and teacher by deemphasizing the importance of interpretation and critique in education, just like design thinking does.

One example of the importance of this kind of flexible and evolving practice — especially for children from low-income families — comes from Lisa Delpit, educator and author of *Other People's Children*. In talks, Delpit uses a situation she witnessed in a preschool in which a teacher handed out a tray of candy and instructed children to each take a piece and pass on the tray. Some of the children took multiple pieces, and there was not enough to go around. A teacher evaluating the children without interpreting the context,

1985–7

Educational computer games become a feature of classroom instruction.

1990

Texas Instruments introduces the TI-81, beginning a graphing calculator craze.

1994

Public schools begin to install Internet access. But even as recently as 2013, less than 20% of educators reported that their classrooms had adequate Internet access, and less than 39% of public schools have comprehensive Wi-Fi.

1998

SMART introduces the first interactive whiteboard to have wide success.

like a machine, would conclude that the children did not successfully complete the task and need more practice in sharing. In fact, after asking why the children took extra pieces, the human teacher found that they were simply engaging in a different kind of creative economy, saving up a couple of pieces to take home to siblings later.

I suspect the innovation Gates is investing in is not a technological one, but a managerial one. The only truly novel thing Sal Khan has done is produce a cheap and popular way to distribute basic lectures and exercises to a large number of people who like them. It's possible that what Gates admires most about him is that one man can teach so many different subjects at different levels, from kindergarten math to cell biology to financial markets. At the Aspen Ideas festival, Gates praised Khan for moving "about 160 IQ points from the hedge-fund category to the teaching-many-people-in-a-leveraged-way category." Look, he seems to be saying, at all the value that can be extracted from one employee!

In a November 2012 interview, Gates told Fareed Zakaria, "When you revolutionize education, you're taking the very mechanism of how people become smarter and do new things and you're priming the pump for so many incredible things. Over the next decade at all levels in all countries, that's going to change quite dramatically." Technology "will take that space at the current investment levels and allow us to do a far better job."

Elsewhere, Gates has called for austerity in public education, repeating the familiar argument that for thirty years we've been spending money while performance by American children remains flat. What we need to do, he says, is raise performance without spending more by changing the way money is spent. To that effect, Arne Duncan asked a room full of Silicon Valley entrepreneurs and investors last year, "Can we find ways to scale the amazing teachers we do have?" Systems that "scale" retain quality under an increased workload. Modifying teachers to scale would mean replacing them with robots or computers.

Managers are incentivized to outsource redundant jobs and tasks, but in the past thirty years there's been a special focus on chipping away at the security and esteem of teachers and the American school system. Certainly it's about money, as it always is, but the financial backing of the Gates Foundation is astronomical enough that the question is less about actual scarcity and more about how the funds will be spent.

The firing and disciplining of teachers is also an ideological choice: teachers threaten the ruling class. Though they are atomized as workers into separate classrooms and competing districts, teachers are, as Beverly Silver puts it, strategically located in the social division of labor. If they don't go to work, no one can — or at least, no one with children to look after. As caretakers, teachers are by definition important and trusted community figures, public care workers who can shut down private production.

In the United States, where the vast majority of families continue to rate their own child's teacher highly, even while believing the political mantra that the nation's education system is rapidly deteriorating — unique job protections like tenure serve to further strengthen teachers' capacity to resist neoliberal reforms.

In the same vein, schools are public spaces in which children and teenagers can put down their pencils or laptops or iPads and organize against state violence and coercion, as we've seen in the aftermath of Michael Brown's murder. The possibilities for confronting injustice are so powerful that children (especially black and brown children, but increasingly, all American children) are literally policed and considered suspects in their own school buildings.

Teachers who encourage resistance are essential sources of support and guidance for kids. People do not learn to think critically and construct meaning in isolation — which is the assumption behind the trend of textbooks that respond individually to each student and allow them to move at their own pace. People argue, discuss, play, experiment, and converse. And, as Delpit writes:

> Only those who are authentically and critically literate can become the independently thinking citizens required for any society's evolution. The opportunity to achieve such levels of literacy is even more critical for those whom

> the larger society stigmatizes … When people of color are taught to accept uncritically texts and histories that reinforce their marginalized position in society, they easily learn never to question their position.

Learning as a group is not a painless process. A good teacher knows her students well, respects them and earns their respect in return, and challenges them to aim for the highest reaches of what Vygotsky called "the zone of proximal development" — their potential. As Katherine McKittrick has pointed out in response to the idea of trigger warnings being placed on college syllabi: the classroom isn't safe. It should not be safe. Teaching, for McKittrick, is a "day-to-day skirmish," and teachers must work hard to create classroom conversations "that work out how knowledge is linked to an ongoing struggle to end violence," to engage with the history that students bring with them into the classroom and resist reification of oppressive thinking in practical ways.

This winter, during the Hour of Code sponsored by the tech industry and supported by the US Department of Education, Susan DuFresne, a kindergarten teacher and former teacher's aid with forty years of experience told me, "Children are not standard. They need unstructured play indoors and out to develop skills" like sharing, listening, cooperation, and self-regulation. The Hour of Code is a publicity stunt in which public school children from preschool up are given laptops and taught to code. DuFresne was vocally opposed. Kids "have different learning styles," she said. "Some learn faster with technology. But now children as early as third grade will be required to type written answers into text boxes, click and drag, and use multiple tech software tools on the Common Core tests." Still, her resistance had little to do with fear of new tools, and everything to do with the conceptualization of the role of technology in the classroom.

Another high school teacher, Brooke Carey, who has been working for over a decade in the New York City school system, agreed that

2008

Poll Everywhere allows real-time student feedback online via text messages.

2009

University of Southern California becomes the first major research university to offer a master's program entirely online.

2010

iPad introduced. Soon after public school districts around the country begin providing tablets to students.

2011

"Skype in the Classroom" introduced.

technology is often used in public-school classrooms in "a fairly traditional way," with iPads serving as a fancier version of pen and paper and Smartboards functioning as computerized chalkboards or dry-erase boards. In American public schools, teaching tools have been digitized and optimized for efficiency, but the content and philosophy remain the same.

Even Google engineers know this. An article in the *New York Times* reported on the popularity of the Waldorf model of education in Silicon Valley as if it were a contradiction: "A Silicon Valley School That Doesn't Compute." Waldorf schools incorporate creative and tactile experiences and tools including hammers and nails, knives, knitting needles, and mud — but not computers — into the curriculum. Engagement comes from the connection between children and their teachers, who stress critical thinking and aim to create interesting, inquiry-based lesson plans.

According to the *Times*, employees at Google, Apple, Yahoo, Hewlett-Packard and eBay send their children to the Waldorf School of the Peninsula. "The idea that an app on an iPad can better teach my kids to read or do arithmetic, that's ridiculous," Alan Eagle, a Google communications executive who's written speeches for Eric Schmidt, told the *Times*.

The great irony is that the very Silicon Valley reformers promoting and funding techno-utopian models for American schoolchildren refuse to submit their own children to anything like it, choosing innovative pedagogical models instead of newer touch screens.

The Classroom of the Future

One of the most powerful moments for me as a beginner teacher was seeing a video of a lesson I gave. The recording enabled me to transcend biology: to get out of my own head and see myself as my students did, to notice and interpret rustlings and undercurrents that would have otherwise escaped me entirely due to purely physical limitations.

In an hour, I learned more about my practice than I had during months of supervisor evaluations. iPads are more than glorified expensive dry-erase

boards. They could be used to connect teachers, who traditionally operate within the confines of their own individual classrooms, to one another for professional development and growth purposes. Why not film the lessons of experienced teachers and compile a national or global library of what an engaging lesson looks like, immediately accessible to new teachers?

What the current conversation about designing the classrooms of the twenty-first century misses is that innovations do not take place outside of the political economy; they are part of it. What we call technology and what we create with it is determined by the social and political landscape in which it is created. As Marcuse wrote in *One-Dimensional Man*, "There is no such thing as a purely rational scientific order. The process of technological rationality is a political process."

For the elite business class, the animating purpose of technology in classrooms is to more efficiently develop human capital, to make some people smarter and faster, and sort out the rest into the discard pile of American capitalism: low-wage labor. Because industrial capitalism makes us all, workers and capitalists alike, dependent on the market for acquisition of the basic necessities of life, we live lives dominated by market imperatives.

The American education system is shaped by those market imperatives — at least for children in public schools. The rich know that JavaScript can be learned in a matter of months. Education for empowerment requires the time-consuming cultivation of a complex understanding of history and one's place in it, as well as how it continues to shape our relationships and political economy.

When we imagine successful teaching as instruction of X number of people achieving Y level of fluency, we redefine it — whether done by human or machine — from a social (and potentially political) to a merely technical act.

Teachers must continue to be able to help children think critically about the ways that reality is reshaped by technology and changes in the mode of production. How will children who take Google for granted understand research and inquiry? What will friendship be like for children of the electronic age, who have the option of never losing contact with childhood friends thanks to Facebook? Who wins and who loses by the adoption of specific technologies?

It's impossible to say today how we should teach and learn about social relations mediated by technology, since that is something that must be shaped by praxis — teachers and students working together. But just to imagine the evolution of education in this way is to ask radical questions, beginning with the forbidden one, "What's wrong with education today?" That question inevitably leads to an even bigger and more dangerous one — what's wrong with society?

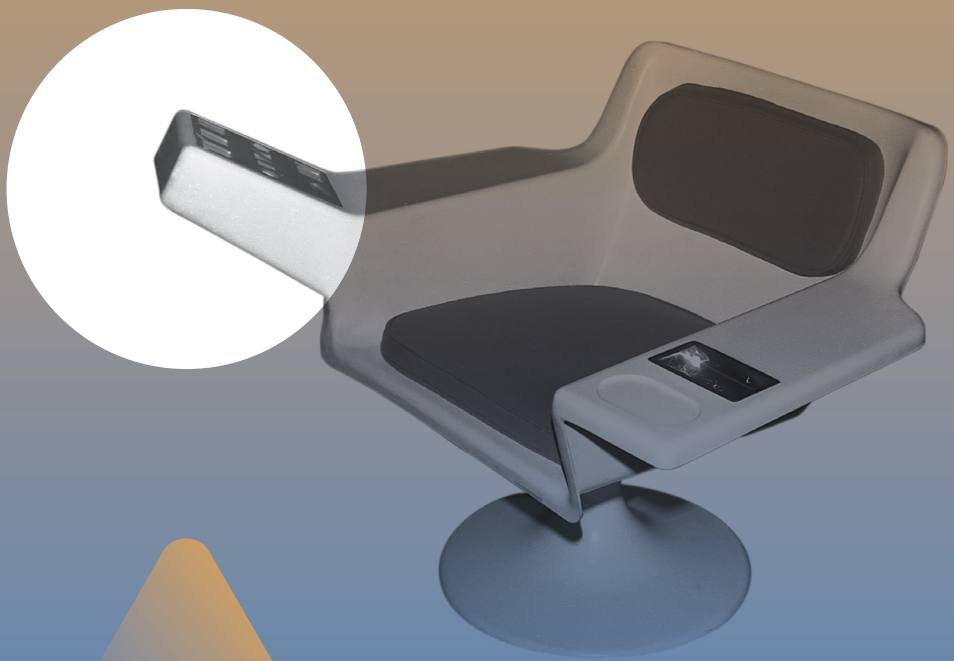
In 1922, a journalist described the way technology changes our relationship to the world: "To the schoolboy of the year 1995 history will not merely be something to be memorized out of books. It will be visualized and made real for him by the moving pictures that are being made now. The people of our time will not be mere history book ghosts to this boy but living creatures who smile at him and walk and play and love and hate and work and eat."

But this isn't the way we see history in 2015. Today, we see history as a dying field, in a separate sphere from STEM education; its practitioners likened to the last speakers of a lost language bent on preserving it, and devalued in the same way as women's work: not well-paid. Humanism is regarded as inherently opposed to machines. And yet, as the journalist of 1922 suggested, technology offers us the ability to form connections and experience intimacy with more people, other people, dead and alive, across time and space.

In a contemporary novel about Victorian England, Sarah Waters has her protagonist notice that the most interesting thing about radio as an invention is not the initial shock of hearing voices across space. "It was even more uncanny to take the ear-phones off and realize that the whisper was still going on — to think that it would go on, as passionate as ever, whether one listened in to it or not."

Over time, technology has transformed the way we relate to each other and the epistemological foundations of society — the way we perceive reality collectively. This is a truly radical opening for socialists, inside the classroom and outside of it. What will we do with it? ■


reprogramming



The Cybersyn Revolution

Five lessons from a socialist computing project in Salvador Allende's Chile.

Eden Medina

While we're often told that the past holds lessons for how to approach the present, we rarely look to older technologies for inspiration. Rarer still is it to suggest that the historical experiences of less industrialized nations may have something to teach us about the technological problems of today — let alone that a decades-old socialist project might offer ways to think about technologies touted by Silicon Valley capitalists. Yet a computing system built in socialist Chile in the 1970s — Project Cybersyn — offers inspiration on how we should be thinking about technology and data today.

Project Cybersyn was a bold technological project tied to a bold political project. It emerged in the context of Chile's peaceful road to socialism: Salvador Allende had won the Chilean presidency in 1970 with a promise to build a fundamentally different society. His political program would make Chile a democratic socialist state, with respect for the country's constitution and individual freedoms.

Giving the state control of Chile's most important industries constituted a central plank of Allende's platform, but created management difficulties. The government had limited experience in this area. Yet by the end of 1971, it had taken control of more than one hundred and fifty enterprises, among them twelve of the twenty largest companies in Chile.

The problem of how to manage these newly socialized enterprises led a young Chilean engineer named Fernando Flores to contact a British cybernetician named Stafford Beer and ask for advice. Flores worked for the government agency charged with the nationalization effort; Beer was an international business consultant known for his work in the area of management cybernetics, which he defined as the "cybernetics of effective organization." Together, they formed a team of Chilean and British engineers and developed a plan for a new

technological system that would improve the government's ability to coordinate the state-run economy.

The system would provide daily access to factory production data and a set of computer-based tools that the government could use to predict future economic behavior. It also included a futuristic operations room that would facilitate government decision-making through conversation and better comprehension of data. Beer envisioned ways to both increase worker participation in the economy and preserve the autonomy of factory managers, even with expanding state influence.

Members of the Chilean government believed the system would bolster the success of Allende's economic program and, by extension, Chile's socialist revolution. Beer named the system Cybersyn in recognition of *cybernetics*, the scientific principles guiding its development, and *synergy*, the idea that the whole of the system was more than the sum of its technological parts.

Even decades removed from its inception, Project Cybersyn still holds valuable lessons for today. First, it reminds us that the state plays an important role in technical design, and can help shape innovations that aim to benefit society and support marginalized groups rather than achieve narrow efficiency goals or single-mindedly increase profits. Second, we need to be vigilant about the ways in which design bias can limit the efficacy of technologies for increased democratic participation and inclusion. Third, while the current stream of new products suggests that technologies become obsolete quickly, using older technologies can actually solve problems while holding down costs and generating less waste. Fourth, protecting privacy is necessary to prevent potential abuses of centralized control of data. Finally, we need to think creatively about changing social and organizational systems if we want to get the most out of technology; technological innovation alone will not make the world a better place.

1. The state and its priorities shape how technology is designed and used.

The state plays an important role in shaping the relationship between labor and technology, and can push for the design of systems that benefit ordinary people. It can also have the opposite effect. Indeed, the history of computing in the US context has been tightly linked to government command, control, and automation efforts.

But it does not have to be this way. Consider how the Allende government approached the technology-labor question in the design of Project Cybersyn. Allende made raising employment central both to his economic plan and his overall strategy to help Chileans. His government pushed for new forms of worker participation on the shop floor and the integration of worker knowledge in economic decision-making.

This political environment allowed Beer, the British cybernetician assisting Chile, to view computer technology as a way to empower workers. In 1972, he published a report for the Chilean government that proposed giving Chilean workers, not managers or government technocrats, control of Project Cybersyn. More radically, Beer envisioned a way for Chile's workers to participate in Cybersyn's design. He recommended that the government allow workers — not engineers — to build the models of the state-controlled factories because they were best qualified to understand operations on the shop floor. Workers would thus help design the system that they would then run and use. Allowing workers to use both their heads and their hands would limit how alienated they felt from their labor.

Beer's idea for democratic participation had its flaws: for example, he didn't consider how coding worker knowledge into the software of a computer system might result in the eventual disempowerment of workers, especially if the political context changed. But Beer showed an ability to envision how computerization in a factory setting might work toward an end other than speed-ups and deskilling — the results of capitalist development that labor scholars such as Harry Braverman witnessed in the United States, where the government did not have the same commitment to actively limiting unemployment or encouraging worker participation.

Braverman published his classic text *Labor and Monopoly Capital* in 1974, at around the time Beer was working for the Allende government. In it, he observed how technologies like computer-controlled

machinery contribute to the automation of labor and lead to the deskilling of workers, even in highly specialized fields such as engineering. He found the same process at work in the context of office computer use. Computers make office work increasingly routinized and give management an easy way to monitor the amount of labor each operator has put in. The increased speed of work has the potential to result in more layoffs.

Beer saw computerization differently, not least because the Chilean state insisted that its socialist computer system be designed for different ends than the ones that Braverman described. This gave Beer the freedom to reconceptualize how technologies might shape work on the shop floor and to see computers as a means of empowering workers.

Project Cybersyn shows that the state can create the conditions for new directions in design thinking. The state can require (and inspire) technologists to consider how systems benefit the interests of the broader citizenry, which may or may not align with profit, market success, efficiency, technical elegance, or coolness in system design. Computer innovation wasn't born with Silicon Valley startups, and it can thrive by taking on design considerations that fall outside the scope of the market.

2. The systems of the future must be free of the biases of today.

Inherited biases won't be shed overnight, which is why we need to remain vigilant about the ways bias can enter into and shape system design. Left unchecked, technologies for increased democratic participation and improved human-machine interaction can also exclude and marginalize sectors of the population. Here, too, Project Cybersyn offers important insights.

Project Cybersyn is best known for its operations room, a futuristic-looking space that was designed to facilitate democratic decision-making. It consisted of seven chairs arranged in a circle within a

The October Strike

Early October 1972

A truck owners association in the rural Aysén Province goes on strike to protest the establishment of a state-owned trucking company.

9 October 1972

The right-wing *Confederación Nacional de Transporte* initiates a nationwide truck owners strike, funded by the CIA's "September Plan."

10 October 1972

Stafford Beer returns to Chile from England to evaluate Cybersyn amid the 12,000-strong strike.

13 October 1972

Now 40,000 truck owners on strike; 80% of stores are closed in Valparaíso, 90% in Viña del Mar. Self-organized worker cooperatives begin seizing trucks, organizing shipping, and continuing production. 8,000 volunteer as replacement drivers in Santiago.

15 October 1972

Fernando Flores proposes using Cybersyn to deal with the effects of the strike.

hexagonal room. The design team insisted on an odd number of chairs to prevent a tie when voting. They also rejected the presence of a table, which they felt encouraged the shuffling of papers instead of lively discussion.

A series of screens lined the walls of the room that displayed data on the state of the economy as well as warning signals indicating areas in need of urgent government attention. The wall displays used color, light, and graphic design in ways that helped occupants quickly grasp the complexities of Chile's industrial sector. Early plans for the room even included space for a minibar.

The chairs in the room exhibited similar hallmarks of careful design thinking. For example, occupants would navigate the displays of information using the "big hand" buttons located in the armrests of the chairs. These large geometrical buttons replaced the traditional keyboard and reflected the class awareness of the design team. They reasoned that Chilean workers would not have experience using a keyboard, and that the geometric buttons offered a user-friendly alternative that allowed for worker participation.

The team considered high-level government officials as the other likely users of the room. These officials also had limited keyboard experience, but for a different reason: they had female secretaries. As Beer noted, adopting a keyboard would "insinuate a girl between themselves and the machinery … [when it] is vital that the occupants interact directly with the machine, and with each other." The buttons therefore provided a way to eliminate women from this decision-making space. They also encouraged forms of masculine expression. As Beer wrote, the buttons could be "thumped" when an occupant wanted to make a point.

Such design decisions were not neutral. They reflected who the design team believed would hold power in Chile's revolutionary context and enforced that vision. Male factory workers and government bureaucrats would have decision-making power. Other kinds of workers, such as clerical workers, and women, would not.

These design decisions illustrate a shortcoming in Chile's revolutionary imagination. They also illustrate how our assumptions about gender and class can travel with us, even as we imagine a future that is more egalitarian and just.

3. We can do more with less, and help the environment in the process.

New technologies come with significant environmental costs in terms of the consumption and disposal of electronic devices. Global sales of electronic devices doubled between 1997 and 2009. According to the Environmental Protection Agency, in 2009, people in the United States disposed of 29.4 million computers and 129 million mobile devices. The US had the highest amount of e-waste in the world in 2012, with a reported 9.4 million metric tons

16–17 October 1972

Allende's administration establishes a central command hub in the presidential palace, using Cybersyn Telex machines to link to specialized command centers for transportation, industry, energy, banking, agriculture, health, and the supply of goods.

18–30 October 1972

During the strike, the Popular Unity government uses Cybersyn technology to communicate with hundreds of factories and communities, requisitioning trucks and coordinating the shipment of goods and raw materials. Cybersyn continues to monitor daily factory output.

20 October 1972

Beer draws "Cybernetic and Political Analysis," a diagram proposing the permanent integration of Cybersyn and Chilean political life.

generated. Much of this waste is handled in places like China, India, and Pakistan, where the recovery of valuable materials such as gold can expose workers to lead and other toxic metals.

The current market for electronic products depends on planned obsolescence: old products quickly become outdated and unfashionable. But extending the life of our electronic devices helps to address the e-waste problem. Project Cybersyn showed that it is possible to create a cutting-edge system using technologies that are not state-of-the-art. It demonstrates that the future can be tied to the technological past.

When Project Cybersyn was built during the 1970s, there were approximately fifty computers in all of Chile, and most were outdated. Nor could Chile call up IBM for help. IBM decreased its operations in Chile following Allende's election because they feared the Chilean government would nationalize them. The Nixon administration had also instituted an "invisible blockade" to destabilize the Chilean economy and prevent Latin America from becoming a "red sandwich" with Cuba on one side and Chile on the other. This further limited Chile's ability to import US technology.

As a result, Beer and the Chilean team came up with an ingenious way to create the data-processing network they needed to link the country's factories to the central command center: they would connect the one outdated computer they had for the project to another technology that was not state-of-the-art: the telex machine — or rather, several hundred of them. And it worked.

In 1972, a national strike that grew to include forty thousand truck drivers threw the country into a state of emergency and disrupted the distribution of food, fuel, and raw materials for factory production. The government used the telex network created for Project Cybersyn to determine which roads were open, coordinate the distribution of key resources, and maintain factory production.

The Cybersyn network improved government communication and substantially increased the speed and frequency at which the government could send and receive messages along the length of the country. It lacked the technological sophistication of ARPANET, the US military communications system that was the forerunner of the Internet and a contemporary of Chile's telex system. But the Chilean network used fewer technical resources at a lower cost and proved highly functional nonetheless. Older technologies were creatively re-envisioned and combined with other forms of organizational and social innovation.

New technology isn't actually as immaterial as many would think. We often speak of our data being stored "in the cloud" — a notion that implies a lack of physicality. But data farms depend on substantial quantities of natural resources. A 15-megawatt data center can use up to 360,000 gallons of water per day, and the recently completed NSA Utah Data Center requires a million gallons of water per day

31 October 1972

Airline pilots strike in support of the truck owners.

3 November 1972

Allende invites two military generals to join his Cabinet and declares a national state of emergency, ending the strike and halting the pro-government industrial activity.

Mid-November 1972

Allende names Fernando Flores as Minister of Economics, based in part on the success of Cybersyn during the strike.

and 65 megawatts of power. A progressive transformation of new technologies would encourage greater selectivity in data collection and challenge the practice of storing of vast amounts of data simply because we can.

Project Cybersyn also demonstrates that more can be done with less. The Chilean project did not try to copy the Soviets' form of economic cybernetics, which collected a wealth of factory data and sent it to a centralized hierarchy of computer centers for further processing. It accomplished the same task by transmitting only ten to twelve indexes of production daily from each factory and having factory modelers spend more time thoughtfully identifying which indexes were most important.

4. Privacy protection can mean the difference between an abusive system and a system that protects and promotes human freedom.

Protecting privacy is key to preventing abuses of centralized control. New technological innovations such as smartphones, the increased use of data-driven analytics, and the push to create smart cities and an "Internet of Things" all make the collection of data easier and permit the recording of vast amounts of human and nonhuman activity.

In the 1970s, critics often characterized Project Cybersyn as a form of authoritarian, centralized control because it collected data on factory activities and channeled them to the Chilean government. *New Scientist*, for example, ran an editorial that declared, "If this [Project Cybersyn] is successful, Beer will have created one of the most powerful weapons in history."

But such interpretations confused how the system actually operated. The misinterpretation was often ideological — in Chile they were tied to more general criticisms of the Allende government by the right-wing political opposition, which claimed that the Allende government was destroying Chilean civil liberties.

In fact, Project Cybersyn did not function as a form of abusive centralized control because it included mechanisms to protect and preserve factory autonomy. These protections were engineered into the system's design. The government, for example, could intervene in shop floor activities only after the software detected a production anomaly *and* the factory failed to resolve the anomaly within a set period of time.

Human and technological limitations placed an additional check on government intervention. Operators in the factory, for example, could not monitor thousands of production indexes a day, but they could track ten to twelve of the most important. Limiting the number of indicators also made it easier for the software to detect the most pressing emergencies in need of government action. However, it required Chilean engineers to make decisions about which data the government truly required.

12 December 1972

Inspired by the popular resistance to the October Strike, Beer writes "One Year of (Relative) Solitude," a proposal to support the "people's autonomy" by further integrating Cybersyn and workers' self-organization.

30 December 1972

Allende personally visits Cybersyn central command center for the first time. The computers malfunction.

11 September 1973

Allende's Popular Unity government is toppled by a military coup, bringing Pinochet to power. Project Cybersyn is discontinued and its facilities are destroyed.

Such limitations made much of the factory's activity invisible to the Chilean government, preserved freedom, and protected Chilean workers from Orwellian abuse. They created a layer of privacy that could have allowed workers to participate in economic management without the overbearing control of outside state bureaucrats.

Beer's framing of Project Cybersyn also gave the workers a way to understand how this form of data-driven regulation worked by allowing them to create the factory models that formed the basis of the Cybersyn software. Theoretically, it allowed them to open up the black box of the computer and understand the operation of the analytical processing taking place within it.

Only theoretically, however, because the Allende government was cut short by a military coup that resulted in the death of President Allende and ended Chilean democracy for the next seventeen years. Military dictatorship and economic policies often described as "neoliberal shock treatments" ended work on Project Cybersyn before it reached completion. For advocates of economic liberalism, it made no sense to have a computer system that helped the state regulate industrial production.

Nevertheless, Beer's framework is useful because it reminds us of the importance not just of computational transparency, but of democratic control. If code is law, as Lawrence Lessig famously proposed, then the code used in the new technologies that shape our lives should not be the exclusive domain of engineers and programmers.

5. We need to think big, because technology alone will not create a better world.

We need to be thinking in terms of systems rather than technological quick fixes. Discussions about smart cities, for example, regularly focus on better network infrastructures and the use of information and communication technologies such as integrated sensors, mobile phone apps, and online services. Often, the underlying assumption is that such interventions will automatically improve the quality of urban life by making it easier for residents to access government services and provide city government with data to improve city maintenance.

But this technological determinism doesn't offer a holistic understanding of how such technologies might negatively impact critical aspects of city life. For example, the sociologist Robert Hollands argues that tech-centered smart-city initiatives might create an influx of technologically literate workers and exacerbate the displacement of other workers. They also might divert city resources to the building of computer infrastructures and away from other important areas of city life. He contends that progressive smart cities should first try to understand human interactions in urban environments and how they systematically produce power inequalities. Technologies should then be integrated into city environments in ways that ameliorate these disparities.

Beer shared Hollands' perspective. Throughout the Cybersyn Project, Beer repeatedly expressed frustration that Cybersyn was viewed as a suite of technological fixes — an operations room, a network of telex machines, an economic simulator, software to track production data — rather than a way to restructure Chilean economic management. Beer was interested in understanding the *system* of Chilean economic management and how government institutions might be changed to improve coordination processes. He viewed technology as a way to change the internal organization of Chile's government.

If he were alive today, Beer would undoubtedly lament that e-government initiatives to put existing forms online or computerize existing processes miss opportunities to make organizations themselves more effective.

We must resist the kind of apolitical "innovation determinism" that sees the creation of the next app, online service, or networked device as the best way to move society forward. Instead, we should push ourselves to think creatively of ways to change the structure of our organizations, political processes, and societies for the better and about how new technologies might contribute to such efforts.

The challenges faced by Cybersyn's protagonists were not unique to their era — we will face similar ones. While the project was far from perfect, its lessons should not be ignored by those seeking a future where technology is democratically harnessed for social good. ■

Red Innovation

Far from stifling innovation, a socialist society would put technological progress at the service of ordinary people.

Tony Smith

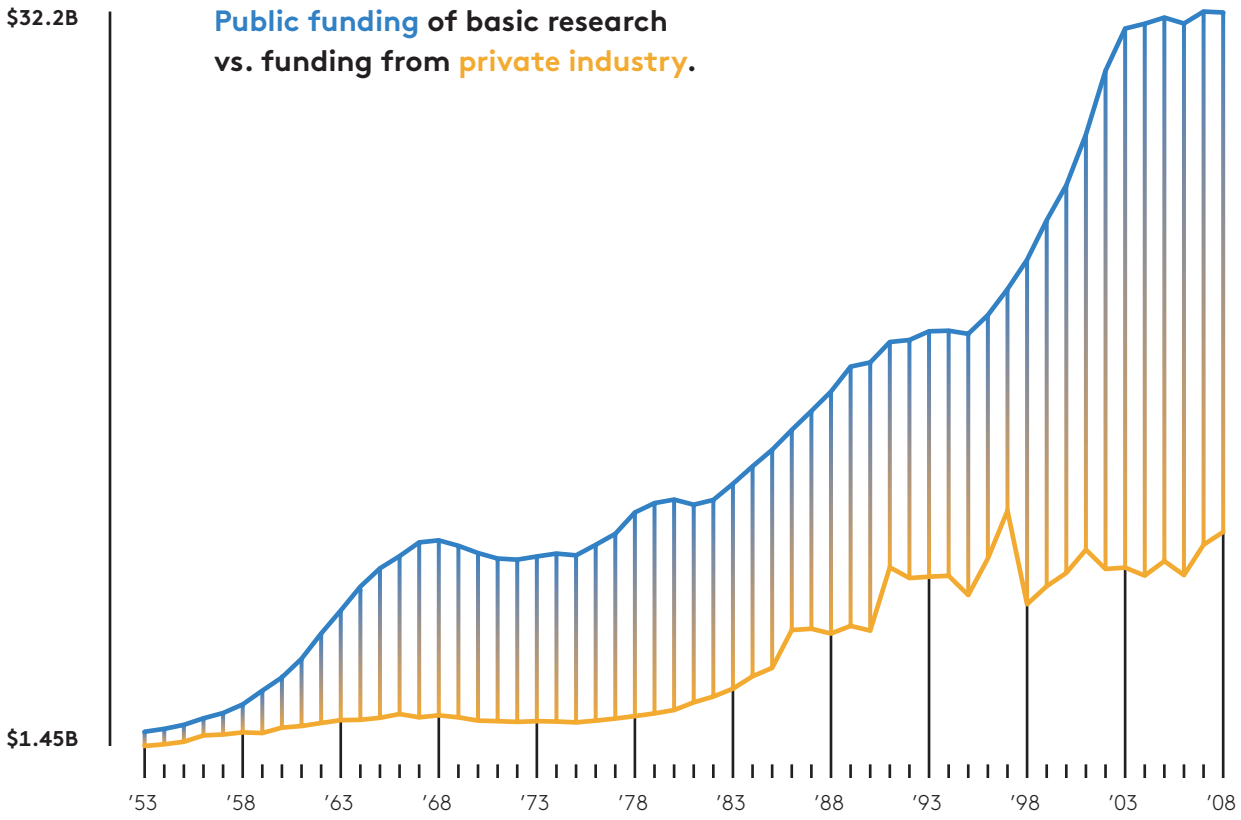
The technological dynamism of capitalism has always been a powerful argument in its defense. But one of its secrets is that at the heart of this change we find neither bold entrepreneurs, venture capitalists, nor established firms.

Investments pushing the frontiers of scientific knowledge are just too risky. The advances sought may not be forthcoming. Those that do occur may not ever be commercially viable. Any potentially profitable results that do arise may take decades to make any money. And when they finally do, there are no guarantees initial investors will appropriate most of the resulting windfall.

There is, accordingly, a powerful tendency for private capital to systematically underinvest in long-term research and development. Despite popular perceptions that private entrepreneurs drive technological innovation, the leading regions of the global economy do not leave the most important stages of technological change to private investors. These costs are socialized.

In the quarter-century after World War II, the high profits garnered by American corporations due to their exceptional place in the world market allowed corporate labs to engage in "blue-skies research" projects. But even then, public funding accounted for roughly two-thirds of all research and development expenditures in the United States, creating the foundations for the high-tech sectors of today. With the rise of competition from Japanese and European capital in the 1970s, private-sector funding of research and development increased. However, long-term projects were almost entirely abandoned in favor of product development and applied-research projects promising commercial advantages in the short-to-medium term.

Too Important for Markets

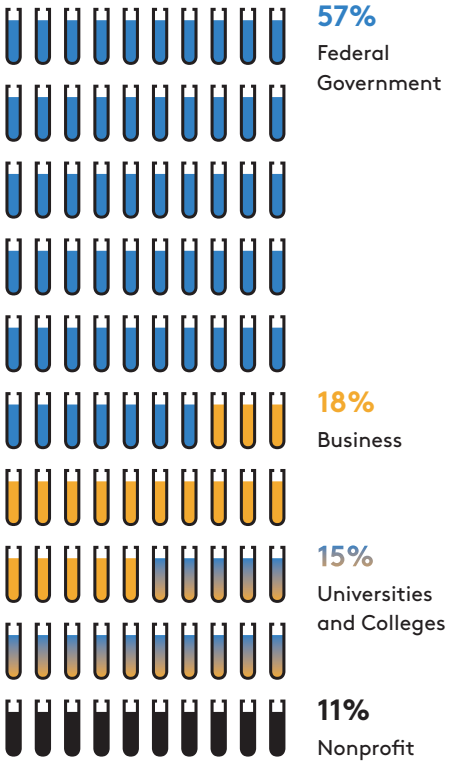


Basic research continued to be funded by the government, like the work in molecular biology that supported the move of agribusiness companies into biotechnology. The same was true for projects of special interest to the Pentagon — the developments associated with the Defense Advanced Research Projects Agency, for instance, which paved the way for modern global positioning systems — and other government agencies. But medium-to-long-term R&D in general was in great danger of falling into a "valley of death" between basic research and immediate development, with neither the government nor private capital providing significant funding for it.

For all their rhetoric touting the "magic of the marketplace," those in the Reagan administration recognized market failure when they saw it. They began to offer federal and publicly funded university laboratories various carrots and sticks to undertake long-term R&D for US capital. New programs were created to provide start-ups with resources to develop innovations prior to the "proof of concept" required by venture capitalists. Under Reagan, the Small Business Innovation Development Act even mandated that federal agencies set aside a

Source: National Science Foundation

Who Funds Basic Research?



percentage of their R&D budget to fund research by small firms. These and other forms of public-private partnership have granted US capital tremendous competitive advantages in the world market.

It's no surprise that Apple's tremendously successful line of products — iPads, iPhones, and iPods — incorporate twelve key innovations. All twelve (central processing units, dynamic random-access memory, hard-drive disks, liquid-crystal displays, batteries, digital single processing, the Internet, the HTTP and HTML languages, cellular networks, GPS system, and voice-user AI programs) were developed by publicly funded research and development projects.

It hasn't been the dynamics of the market so much as active state intervention that has fueled technological change.

The Promised Golden Age

Technology is more than just a weapon for inter-capitalist competition; it is a weapon in struggles between capital and labor. Technological changes that create unemployment, de-skill the workforce, and enable one sector of the workforce to be played against another shift the balance of power in capital's favor. Given this asymmetry, advances in productivity that could reduce work time while expanding real wages lead instead to forced layoffs, increasing stress for those still employed and eroding real wages.

Two ongoing technological developments further strengthen the power of capital. Advances in transportation and communication now enable production and distribution chains to be extended across the globe, allowing capital to implement "divide and conquer" strategies against labor to an unprecedented extent.

Astounding new labor-saving machines are also becoming more and more inexpensive. A recent exhaustive study of over seven hundred occupations concluded that no less than 47 percent of employment in the United States is at high risk of being automated within two decades. Anything approaching this level of labor displacement will yield more misery, not progress, for ordinary workers.

But the lower cost and higher capacities of machines have also led to change of a better sort. As the prices of computer hardware, software, and Internet connections have declined, many people can now create new "knowledge products" without working for big capitalists. Multitudes across the globe now freely choose to contribute to collective innovation projects of interest to them, outside the relationship of capital and wage labor. The resulting products can now be distributed as unlimited free goods to anyone who wishes to use them, rather than being scarce commodities sold for profit.

It is beyond dispute that this new form of social labor has generated innovations superior in quality and scale to the output of capitalist firms. These innovations also tend to be qualitatively different. While technological developments in capitalism primarily address the wants and needs of those with disposable income, open-source projects can mobilize creative energies to address areas capital systematically neglects, such as developing seeds for poor farmers or medicines for those without the money to buy existing medications. The potential of this new form of collective social labor to address pressing social needs across the globe is historically unprecedented.

In order to flourish, however, open-source innovation requires free access to existing knowledge goods. Leading capital firms, hoping to extend their ability to privately profit from publicly supported research, have used their immense political power to extend the intellectual property rights regime in scope and enforcement, severely restricting the access open-source projects require. Copyright, after all, was extended for twenty years at the turn of the century, just as Internet access was starting to balloon.

Despite these barriers, the success of open-source projects shows that intellectual-property rights are not required for innovation. Further evidence is provided by the fact that most scientific and technological workers engaged in innovation are forced to sign away intellectual property rights as a condition of employment. These rights actually hamper advancement by raising the cost of engaging in the production of new knowledge, and by diverting funds to unproductive legal costs.

The World is Flat?

Capitalism also hampers the ability of much of the world to contribute to technological advancement. Whole regions of the global economy lack the wealth to support meaningful innovation. Today, only four countries spend over 3 percent of their GDP on research and development; a mere six others devote 2 percent or more. Capital in these advantaged regions has the opportunity to establish a virtuous circle, free-riding on the extensive public investment discussed above. Privileged access to advanced R&D enables capitalists to appropriate high returns on successful innovations; these returns allow those companies to make effective use of technological advances in the next cycle, setting the stage for future profits.

At the same time, enterprises in poorer regions, lacking access to high-level R&D, find themselves trapped in a vicious cycle. Their present inability to make significant innovations that would enable them to compete successfully in world markets undercuts their future prospects. Only a handful of countries — such as South Korea and Taiwan — have ever been able to move forward from this starting disadvantage.

Global disparities in technological change alone do not explain why 1 percent of people in the world now own 48 percent of global wealth. But they are a major part of the story; technological change is a weapon that enables the privileged to maintain and extend their global advantages over time.

Creative Non-Destruction

The destructive effects examined above are not necessary features of technological change; they are necessary features of technological change in capitalism. Overcoming them requires overcoming capitalism, even if we only have a provisional sense of what that might mean.

The pernicious tendencies associated with technological change in capitalist workplaces are rooted in a structure where managers are agents of the owners of the firm's assets, with a fiduciary duty to further their private interests. But a society's means of production are not goods for personal consumption, like a toothbrush. The material reproduction of society is an inherently public matter, as the technological development of capitalism itself, resting on public funds, confirms. Capital markets, where private claims to productive resources are bought and sold, treat public power as if it were just another item for personal use. They can, and should, be totally done away with.

Large-scale productive enterprises should instead be acknowledged as a distinct type of public property, and exercises of authority within these workplaces as acts of public authority. The principle

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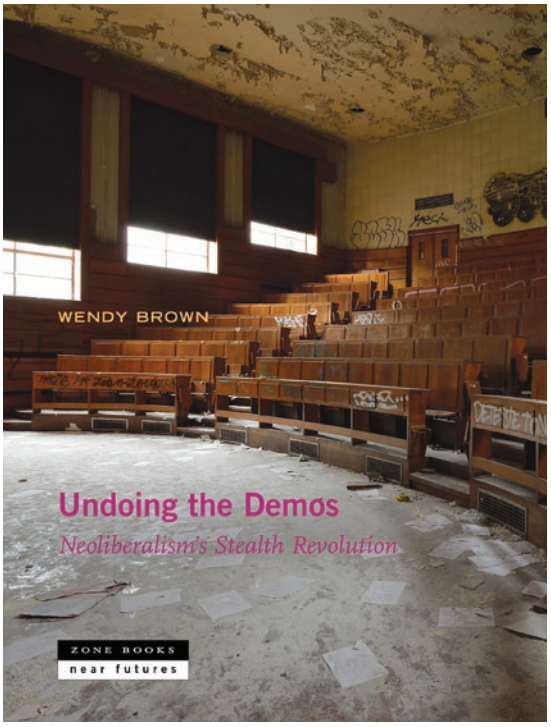

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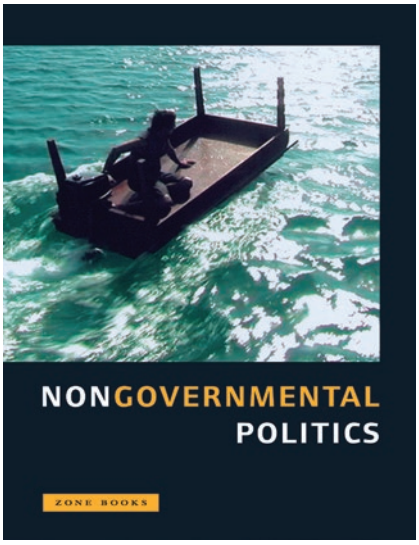

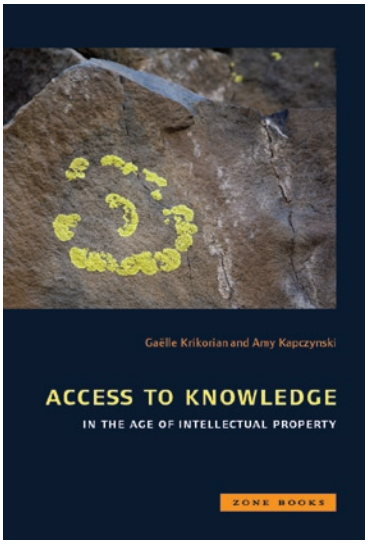

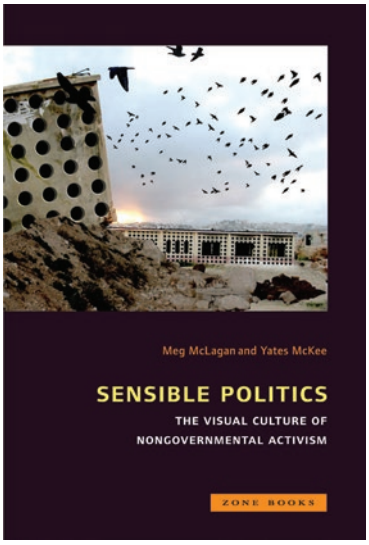

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of democracy must then come into play: all exercises of this authority must be subject to the consent of those impacted by it.

Though additional regulations would be needed if managers were elected and subject to recall by the workforce as a whole, technological advances in productivity would not typically result in the involuntary unemployment of some and the overwork of others, but rather in reduced work for all. We know this because workers say they want more time to spend with their families and friends, or on projects of their own choosing. With democracy in the workplace, the drive to introduce de-skilling technologies would be replaced with a search for ways to make work more interesting and creative.

Suppose that decisions regarding the general level of new investment were also a matter for public debate, eventually decided by a democratic body. If there were pressing social needs, the overall rate of new investment could be increased; if this were not the case, it could be stabilized. These bodies could then set aside a portion of new investment funds to provide public goods free of charge, putting more useful goods and services outside the market's reach.

The public goods of scientific and technological knowledge resulting from basic research and long-term R&D would be decommodified, too, as would the fruits of open-source innovation. The latter could be unleashed by abolishing intellectual property rights and by providing an adequate basic income to all — enabling anyone who wished to participate in open-source projects to do so. If special incentives were required, generous prizes could be awarded to the first to solve important challenges.

Remaining funds could then be distributed to other elected bodies at various geographical levels, each of which would determine what share would go to public goods in a region. The remainder would be distributed to local community banks charged with allocating them to worker enterprises. Various qualitative and quantitative measures could be employed to measure the extent to which those enterprises used technologies to meet social wants and needs effectively, with the results determining the income beyond the basic level received by their members (and the members of the community banks that allocated investment funds to them).

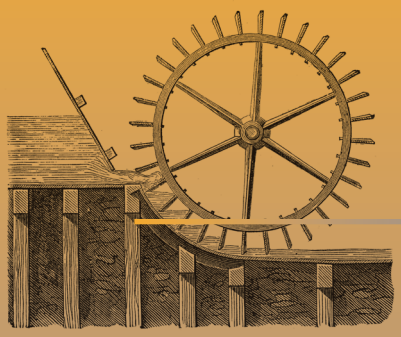
Abolishing intellectual property rights would have the added benefit of ensuring that wealthy regions could not use technological knowledge as a weapon to create and reproduce inequality in the global economy. This danger would be all but eliminated if every region were granted a fundamental right to its per capita share of new investment funds.

Finally, if workplaces used productivity advances to free up time for their workers rather than to increase the output of commodities, resources would be depleted and waste generated at a much lower rate. Abolishing capital markets and replacing them with democratic control over levels of new investment would free humanity from the "grow or die" imperative and the environmental consequences that follow from it.

If enterprises were acknowledged as inherently matters of public concern, it would eliminate the obscene absurdity of having the fate of humanity rest on whether profit-driven oil companies have the political and cultural power to extract and sell an estimated $20 trillion of fossil-fuel reserves, as they clearly plan to do. If open-source innovation flourished, the creative energies of collective social labor across the planet could be mobilized to address environmental challenges. If poor regions with fragile ecologies were guaranteed their fair share of new investment funds, the pressure to sacrifice long-term sustainability for the sake of short-term growth would be overcome.

Of course, all of these proposals are vague and provisional. Nonetheless, they show that the social consequences of technological change could be far different than they are today. We do not need private ownership of productive assets, or markets devoted to financial assets, to have a technologically dynamic society. With the necessary political shifts, technological change would no longer be associated with overaccumulation, financial crises, the stifling of open-source innovation, severe global inequality, or the increasingly palpable threat of environmental catastrophe.

We need to unleash the full potential of human ingenuity. The way technology advances is already socialized in important, if restricted and inadequate ways. We can finish the job and make sure that its fruits are put to the benefit of ordinary people. ■



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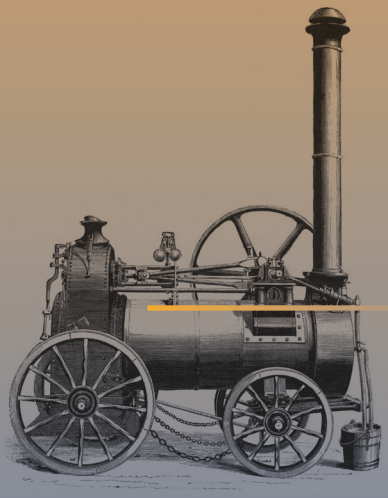

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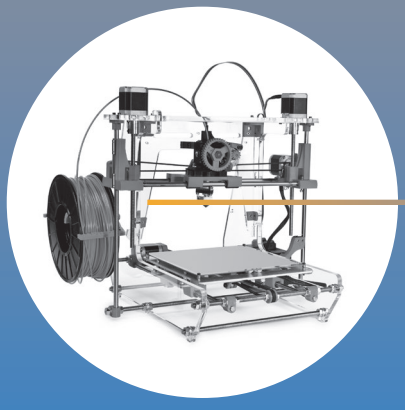

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All Power to the Makerspaces

3-D printing in its current form could be a return to "small is beautiful" drudgery, but it has the potential to revolutionize the way we produce goods.

Guy Rundle

Beneath the labs and offices of the materials building at Michigan Tech, in a sprawling basement, a young physicist named Josh Pearce is making a five-cent water filter. Or rather, it's being made for him, a 3-D printer whirring back and forth across a heated bed, a laptop telling the nozzle which way to move back and across.

Pearce's research team is gathered round, watching to see if the machine can handle the tiny latticework in the filter's core. Around the room behind them, among cluttered shelves and workbenches, there are half a dozen other printers, large flatbeds, and narrower, taller delta ones moving up and down.

On the other side of the basement, a technician is working on a shredder that will make it possible to recycle plastic waste into the "filament" polymer that the printers use as raw material. She occasionally glances at a smaller machine nearby turning out a new creation. "Oh, that's a DVD tower," she says, distracted. "I'm doing it for home."

On the big machine, the filter appears to be a success. "Looks like we're off to the races," Pearce says, beaming. He will say it several more times over the course of the afternoon.

The Pearce Research Institute, set in a range of offices and labs in the old mining school of Michigan's frozen Upper Peninsula, has a hokey, ready-made air, but it also has a deadly serious mission: to accelerate the development of 3-D printing and other replication

technologies — to create technologies capable of transforming life for people across the world.

The place was on the way to becoming the sort of production center it aspired to spread across the globe: a space where people worked in fluid interaction with scalable technology, applicable to every part of their lives.

That's the vision of this new technology at its best. For a while, it was popularly accepted, with a new 3-D printing story daily. These stories touted a wildly optimistic future in which all goods would be effortlessly produced.

The bubble burst when people saw actually existing 3-D printing, especially in its nascent commercial versions in the new so-called "maker" shops in major cities: small machines slowly turning out toys in tacky plastic polymer filament. There was also a reaction to some of the utopian celebrations of the new technologies in the "makerspaces" that were springing up.

The maker movement arose from diverse sources — hackers moving from soldering to welding and beyond, hipsters crossing from steampunk fantasies into realities, counterculturalists exploring new possibilities — but they all had in common a carryover of the New Left idea that any revolution in production had to include a commitment to a production process that offered authenticity and meaning through a renewed engagement with the physical world.

This is a fine thing for people to pursue in their lives, but to generalize it as a precondition for a transformed production system would mean a different sort of misery. That would simply reinstall another form of obligated labor in place of wage labor. The rhetoric suggesting that instead of buying household implements, people should weld their own Burning Man–styled toasters in a converted warehouse in Bushwick is exactly the sort of nightmarish vision that will have people running back to neoliberal capitalism in a heartbeat.

For many, it rightly looked like a return to the "small is beautiful" celebrations of the 1970s, and the drudgery that came with them. And when the 3-D-printed gun, made by a Southern libertarian, hit the top of the news, many had an excuse to move past the new technology altogether.

In the mainstream, 3-D printing was now another source of fear. Among the Left, it was another foolish technological quick fix, diverting people from the hard slog of real politics.

Given the public image of 3-D printing, the dismissiveness is understandable, but it's an error nonetheless. 3-D printing — properly called replication — has been around for no more than thirty years. It was designed as an industrial prototyping process in the early 1980s. Patenting and high unit costs kept the technology within the industrial sphere, but in 2005, the British engineer Adrian Bowyer began a project known as the "reprap" (replicating rapid prototyper) to collectively design an open-source 3-D printer that was not only affordable but could also print out the parts to assemble a copy of itself, thus setting up an endless chain of replication.

The first reprap, called Darwin, was produced in 2007. It's a Meccano type, steel-framed cubes with whirring, moving nozzles. All the numerous commercial models of 3-D printers now on the market are some version of repraps.

Development of the open-source model continued in parallel, with impressive results. Versions capable of printing out objects more than a meter and a half in each dimension, such as the Gigabot, are now available for a few thousand dollars, and the materials available for use have expanded from the familiar tacky polymer to include synthetic wood, ceramics, and eventually, the holy grail, metal. As the speed of deposition increases, and robotic feedback loops make the reprap into a genuinely autonomous machine, the possibilities of everyday replication expand exponentially. Machine design is a global open-source project, and so too are product designs, uploaded to Thingiverse and similar websites.

Quietly, after the news buzz subsided, modular, scalable replication started heading toward a convergence point, a moment at which all the sub-technologies cross a certain point of development, and replication enters a new stage wherein its products are radically competitive with industrial, privately controlled processes.

This is what makes replication different from the "alternative" movements that came before it. Those movements tried to turn away from industrial

More than a Novelty

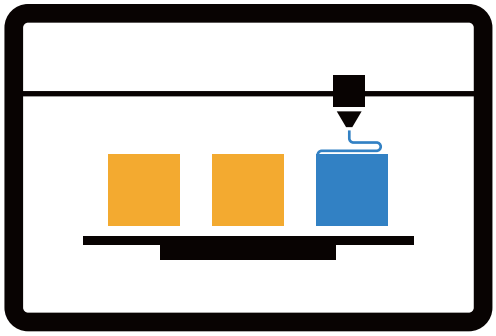
production and toward more meaningful but less efficient ways of making things. Replication has the potential to be both more meaningful and more efficient.

The reprap principle is, quite simply, that for all the products that can be produced, the unit cost approaches zero over time (maybe a considerable time). That is, if the reprap machines themselves become more efficient and work effectively, with supervision time approaching zero, their energy supply will be renewable technology, itself printed out, and recycled materials will provide much of its raw materials. Such a transformation of production of common objects should defeat capitalist strategies to recuperate and re-enclose, because it inherently undermines the preconditions of capitalist value relations. Simply advancing and extending the uses of such technology for real-life production becomes a political act (though merely a necessary, not a sufficient one). It is less important whether such services are extended as free collective activity, or on some sort of minimal-fee basis, than that they are extended into everyday life — thus drawing us closer to the point at which a change in quantity becomes a change in quality, and overall value systems start to be transformed.

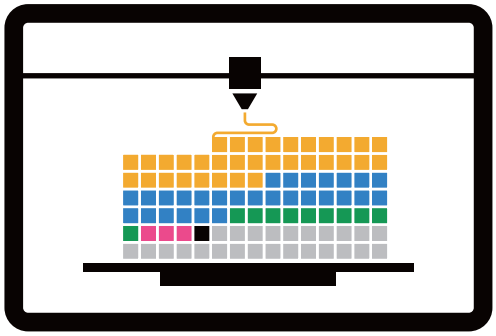
Replication is thus a new force of production, but it is also the root of a new mode of production, capable of grounding more liberated social relations.

The promise and possibility of replication is not that of the robotic technological dystopias, which occupy mainstream fantasies and which implicitly involve a surrender of human autonomy.

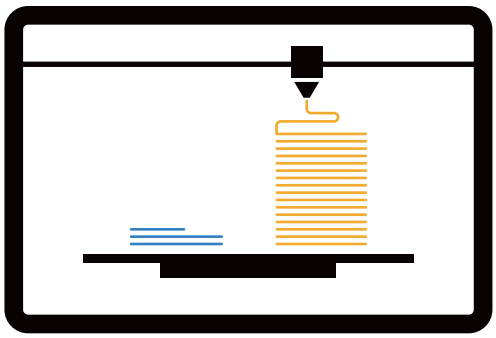
Replication does not offer an end to necessary activity, but it does offer the possibility of a layer of life that approaches an everyday communism, one



33% of top manufacturers are using 3-D printing.



30% were experimenting with the technology, 25% said they were using it for prototyping only; 10% for both prototyoping and production, 3% for building products that couldn't be made with traditional methods, and 1% for final products or components.



The global market for 3-D printers and services is expected to grow from $2.5 billion in 2013 to $16.2 billion in 2018 — a compound annual growth rate of 45.7%.

in which many of the necessities of life can be produced either in a home-based replicator, or (for more complex objects) a locally based production hub, an entity which would be both a collective locus of free activity and a client-based service.

When replicators are combined with other technologies such as CNC routers (cutting tools), most of the products now purchased within the global capitalist circuit can be produced for a vastly reduced cost at a comparable level of quality. Furniture, large equipment, and entire houses — currently underway in China, the Netherlands, and the United Kingdom — can be produced. The latter can be printed with plumbing and electrical and fiber-optic cabling built in.

Sketching out possible futures in detail is an old bad habit of the Left. But refusing to say anything about concrete possibilities is a more recent, equally self-defeating one, so let me say a few words about one possible trajectory associated with the increasing spread of replication.

"Hubs" activated within existing economic frameworks could appeal to three groups:

1. The politically self-motivated, many of them pursuing autonomous, creative lives, who want to radically reduce their cost of living without pursuing the old bohemian path of virtuous penury;

2. The poor, with varying degrees of self-conscious political awareness, for whom such near-zero-cost production may become a necessity;

3. So-called makers, who want a specific degree of involvement in production for a variety of reasons.

Much attention has been focused on the latter group, but it is the two other, larger groups that offer the promise of a new production movement that combines individual interest with collective advantage and that offers the promise of autonomous expansion; a movement that is inherently political and transformative.

Even within a capitalist economy, production hubs could offer various possibilities of connection, from allowing people to actively use them and produce their own stuff virtually for free, to having them pay a regular fee for unlimited production — similar to a gym membership. Such a process could create a countervailing movement of post-capitalist relations within the existing framework, and thus become a political force in its own right, with its own interests.

Such a movement would face great opposition, but much of the power of that opposition is overstated, even or especially by sections of the Left. Intellectual property and knowledge enclosure have been cited, but the replication movement is now so massively open-source, and has such a variety of methods, that re-enclosure is impossible. Recuperation and recommodification by capitalism have been cited, with the examples of the "free" internet and cultural sharing. But the point of the replication movement is to create a production process that does not yield the possibility of profit, except at a vanishingly small degree.

The "free culture" of the Internet never eventuated because valued cultural products remained scarce enough to be commodified. There is no shortage of free music, film, or writing on the net, but Taylor Swift and *The Wire* remain proprietorial. The aim of this "material revolution" is to apply production that approaches no cost to common objects, not specific ones.

Legal regimes like oppressive regulation could also be applied. Resistance to attempts to wipe out competition against capitalism would then become an explicitly political struggle — with the advantage of being conducted as a fight for something already established, rather than for a future potentiality.

This is analogous to the role of mass squatting in urban struggles, which occupy territory prior to making a more articulated claim of right to it.

A movement that takes seriously the idea that replication represents a new and liberating mode of production is one that takes seriously the determinist dimension of Marx, present in both his notification that the "mill wheel gives you the feudal lord, and the steam engine the capitalist," and in his "Fragment on Machines," which reflected on the shift in value form that would accompany the shift to largely autonomous machines.

Refocusing on the transformation of production as a political act also involves some reflection on the long history of revolutionary politics. One of the great contributions of Marxism to such politics has been the insistence that radical possibilities come not merely from collective will, but from an understanding of the external situation, particularly its economic aspects. It seems very possible that replication is part of a new technological stage of development that brings the capitalist mode into crisis at the level of the base, while also offering a system of equal and liberating production that is neither bureaucratic nor reliant on wage labor.

But it is crucial to separate a transformational and liberating political-technological movement from one that becomes embedded within a quasi-spiritual framework, reoriented to the existential act of production. This conception, central to the maker movement, has become entangled in the public understanding, with disastrous results. The idea that any liberation of production must involve an intimate re-engagement with all aspects of it is not liberation, but simply a restoration of an earlier stage of compulsion, with a strong dose of moralism included. Such an emphasis would repeat all the errors of the counterculture movement of the 1960s, particularly the idea that human alienation can be substantially overcome through an act of will on the part of individuals and small groups. This idea led to the creation of societies based on earlier modes of production, with the hope that a free human essence — no longer buckling under the weight of oppressive capitalism — might spring forth fully formed.

Though relatively few people made the break and actually began to live on self-sustaining communes, the idea that sustained them — that any post-capitalist society would demand a mass re-involvement in production and a preservation of its repetitive and dull aspects — came to dominate conceptions of a new world. The implicit proposal was that the authenticity of the act would not only compensate for the renounced pleasures of modernity, but that those pleasures would cease to be meaningful at all. Countercultural people would be willingly stripped of their commodified desires, and their humanity would re-emerge whole and entire.

The reality, of course, was that initial good feelings quickly developed into drudgery, the tastes and desires of modern human beings never left them, and the movement collapsed within half a dozen years. The counterculture was the last, or latest, gasp of the pastoral urge that runs through civilizations from the first beginnings of cities, and inhabits notions of the "noble savage" — the contradictory idea that we might take our modern subjectivity and decant it whole into a prior form.

The proposition that through the sheer force of ethical will, humans formed in modernity could overcome their contradictory desires, individualist and collective, in a fusion of both, set the movement up for rapid failure, and a collapse into the reverse pseudo-ethic of the Reagan-Thatcher years. A revolution in production must be a liberation of time and life activity, not an addition of new obligations.

This is not to say that, once the costs of the mass-production of life start trending toward zero, people will not choose areas of life to sensualize with particularity, whether by physical production, or by using liberated time for renewed life activity. But that can only come as a choice rather than an imposed necessity, and it is that possibility that gives replication a communistic orientation.

The possibilities of the technology also serve to reunite the fate of the relatively prosperous and relatively poor with the wretched of the earth. Thus, while the Pearce Research Institute works on a plan to put two complete repraps in a suitcase that could be taken anywhere to make water filters, machine parts, implements, and more repraps, the objects of the present world can be fashioned at the same time. If there's a vision of what a genuinely transformed life might look like, the labs of the Pearce Research Institute are a first approximation — a core of people at home with technology, using it in a protean and flexible way, with ever-widening circles around them, able to access production and innovation without needing to be dominated by it.

What can we know for sure about its possibilities? Only that it they will not unfold in the manner precisely foretold. Things never do. But it is necessary to imagine the wildest possibilities of these new technologies, and an expanded idea of what their revolutionary politics might be. ■

Seasons Change, Mad Things Rearrange

Appeal to Reason and the various outlets that surrounded the Socialist Party of America a century ago are largely forgotten.

That's a shame, because whatever their flaws, these newspapers managed to harness sophisticated publishing techniques to serious political ends. Among the most popular papers in the country, by 1910, *Appeal to Reason* reached 750,000. The bundles of one special issue weighed 120 tons.

Though the *Appeal* was reliant on a sometimes hostile postal service, it not only followed developments in bourgeois publishing, but pioneered its own innovations.

Things, of course, did not last. *Appeal*'s decline was partly the result of state repression and its own internal contradictions. Its fortunes fell, for many of the same reasons, alongside those of the Socialist Party.

Radical media has not come close since and developments in the decades that followed made it more difficult to return to our early heights. Within years, new communication technologies like radio and television emerged. Without strong enough movements to push for democratic control of these mediums, dissident voices were shut out. With few exceptions, the Left was stuck in print, cranking out broadsheets on aging mimeograph machines.

Things have gotten a bit better recently. Under capitalism, the Internet will never be able to live up to its egalitarian promise, but it allows leftists to compete on more even terrain. Last December, *Jacobin*'s website registered 1.5 million views, a respectable number even by mainstream standards.

Though traditionalist publications like *Harper*'s say "fuck the Internet," *Jacobin* has a political duty to reach as many people as possible with free and accessible content — yes, "content."

In 2015, that means publishing 750 articles online, in addition to our quarterly magazine and book series. It means understanding, if not embracing, modern web publishing and figuring out how that mysterious Facebook algorithm works.

But it is difficult and expensive for a young institution to undertake so much. That's why our small core of paid subscribers are vital.

Maybe you subscribe to *Jacobin* because you like having the print magazines around or enjoy the layout in .PDF form, or maybe you buy issues just out of political commitment, but your decision to pay for what we release freely online is the only reason the magazine survives.

We've been building *Jacobin* for four years now and who knows what the future holds. My hope is that we can slowly build our rolls to a core of at least 25,000 subscribers. Perhaps then we'll have to be patient and continue to engage with ideas and new movements until political conditions change. Or maybe by that point *Jacobin* will have outlived its usefulness to the emerging left.

In any case, we want you along for the ride — not just for your financial support, but your input. Consider getting a lifetime subscription for a friend, send a donation to Jacobin Foundation, and e-mail us your pitches and thoughts to submissions@jacobinmag.com

Appeal to Reason and others used to broadcast their circulation numbers in issues. It helped get readers invested in the fates of the publications they relied on. These listings weren't always triumphant bulletins, some included distraught appeals from editors and tales of financial woes, even threats of imminent collapse. We'll try to cause you less stress, but starting this issue *Jacobin* will follow in the same tradition.

Circulation: 11,400
Web visitors: 825,277 (December 2014)

The numbers may dip embarrassingly in the future, but we want you to see our project for what it is now and what it, with your help, could become.

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—Lincoln Steffens