

AUTO-INDUSTRIALISM

DIY CAPITALISM AND THE RISE OF
THE AUTO-INDUSTRIAL SOCIETY



PETER MURPHY

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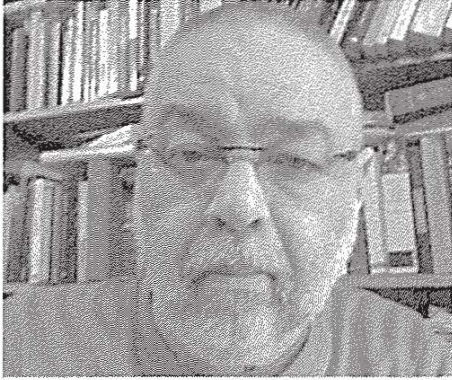
Dedicated with much love to Christine Mintrom

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ILLUSTRATION

1 US employment by major occupational group, 2014 and projected to 2024

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INTRODUCTION: THE RISE OF AUTO-INDUSTRIALISM

AUTOMATION AND THE AUTOMATIC SOCIETY

We have entered a period of momentous structural change.¹ For those old enough to remember it, the shift we are experiencing is like that of the 1970s. Then we saw the onset of the post-industrial age. Mass manufacturing industries in the leading economies contracted. Parts of them were exported abroad — to China and elsewhere. The number of well-paid, blue-collar industrial jobs shrank dramatically. Lesser-paying service jobs expanded along with white-collar, professional and para-professional work. The latter was fuelled by an expanding public sector. The government-education-and-health slice of the economy swelled. Theories of human capital and public goods boomed in popularity. This was accompanied in the private sector by the growth of media and communications industries and the information and knowledge economy. Information technology (IT) became pervasive. Computers appeared everywhere. Processes and products were digitized and networked.

The post-industrial world, which we became familiar with, is now itself beginning to disappear. The shift to a markedly different social model — auto-industrialism — is underway. The signs of this are all around us. Go to any big supermarket retailer today and you will see arrays of self-service check-outs. The auto-industrial era is an age of self-service. It is marked by a rising tide of do-it-yourself (DIY), automated and robotic processes. There are continuities with the post-industrial age. The ubiquitous computer remains ubiquitous. However some things are noticeably different. Auto-industrialism does part of what post-industrialism did. But it automates it. Customer-facing retail jobs were standard post-industrial fare. These are now being replaced by automated online purchasing even at bricks-and-mortar locations.

In the United Kingdom, between 2000 and 2015, 750,000 net jobs were lost in manufacturing and 338,000 in wholesale and retail. Two million jobs in that country (60 percent of the current retail workforce) are predicted to disappear



from the wholesale and retail sector by 2036.² In-store shoppers increasingly prefer to interact with computers that provide information to assist their purchases rather than a sales clerk.³ Instead of being told by a sales assistant that an item is 'not in stock', machine-mediated retailing can sell customers goods that are not in-store but can be ordered for later pickup or delivery. The phenomenon of 'click-and-collect' goods is on the rise with purchases made online and collected by the customer later from a physical location.⁴ The American retailer Macy's is adapting their chain of stores to function as pickup points for online purchasing. Supporting this in the background are computer algorithms that manage the retailer's inventory.⁵ Eventually delivery by concierge-style sole contractors and then drones, driverless cars and other robotic means will complete the online purchase system. A pilot is presently being conducted in the United Kingdom of knee-high, shopping cart-sized delivery droids to service the last mile of retail delivery (which currently represents 30 to 40 percent of business delivery costs).⁶

Shops are not disappearing but their functions are changing. They are turning more into collection, experience or try-before-buy destinations than places of assisted sales.⁷ The numbers of sales assistants are shrinking.⁸ Naturally there is an element of commercial cost-saving in this just as (conversely) there remain customers who prefer the 'personal touch' and expect to deal with a store clerk. Yet it seems that the latter is a smaller cohort than once might have been assumed. Many individuals, it seems, prefer to be left alone when they make purchases.⁹ Australians today receive 36 million postal packages annually containing goods they have purchased online. Online retailing in the United Kingdom was 13.5 percent of market share in 2014 and 15.2 percent in 2015.¹⁰ The US figures were 11.6 percent and 12.7 percent, respectively.¹¹ Each purchase replaces human-human interaction with machine-human interaction. A decade ago, people who booked overseas holiday travel used a travel agent; those numbers today have halved. Self-service, DIY, online ordering-and-paying has visibly reduced the industry. Large numbers of people have decided that the time cost of doing-it-yourself outweighs the service value of a white-collar, or rather T-shirted, industry operator doing it for you. Even in the realm of high culture, similar kinds of changes are occurring. Online art galleries are becoming increasingly important. They are in part displacing physical galleries. André Malraux's 'museum without walls' is being realized. Human-machine interaction provides individuals with ready access to artworks whenever and from wherever.

Machine automation is an expression of a deeper social shift. The growth of participation in and enjoyment of human-machine interaction over the historic

term indicates increasing levels of comfort with an automated society. This is a distinctive kind of modern society. It is one that is dominated by the impersonal patterns of markets, industries, cities and publics.¹² In an automated society, economic and social cycles, ratios, fractals and proportions play a decisive role in long-term social development. They play a more decisive part than do directives, regulations, procedures, policies or rules. The tendency to automate social functioning is characteristic of high-functioning modern societies and economies. These have, to a notable extent, an impersonal, autonomously operating, self-regulating nature. They are animated by business, technology, political and urban cycles, phases and relations that have a quasi-life of their own. The price-to-earnings ratio, the debt-to-GDP ratio, the ideal or 'golden' ratio, the Fibonacci number series, the power law of city size, the Pareto (80–20) principle of cause-and-effect and scaling laws (like the quantity theory of money) provide constants in dynamic growth-orientated societies. These constants are not legislated; they are not tools for social engineering. They are not instruments designed for state intervention. Rather they provide durable form in fluid social environments. These environments change rapidly and yet their underlying principles are remarkably stable over time.

Social laws in a world of freedom, surely not?¹³ Yet the paradox is that societal self-regulation and machine automation, far from being hostile to human freedom, are conducive to high levels of personal autonomy and individual freedom.¹⁴ The impersonal in this case strengthens the personal. At the level of industrial automation, impersonal interaction with machines allows individuals to more readily do things for themselves and reduces the pressures that accompany everyday functional and official relationships. Assuming it works well, human–machine interaction reduces the pressure of sales talk. It alleviates the strain of dealing with petty officials and counter clerks. It removes the pain of listening to the spurious chatter of real estate agents. It obviates the ill-informed advice of the town council's trainee planning assistant. In short, it reduces the tiny coercions of everyday public life.

Machines do not suit everyone. Some people prefer dealing with other people than dealing with machines. They resolutely resist the use of appliances and devices. Yet the popularity of automated teller machines (ATMs) for bank cash withdrawals suggests that technophobic attitudes to new generations of machines shrink over time. The first ATM was installed in 1969; there are now three million of these machines worldwide. Such is the nature of industrialism that even machines are replaced by machines. Today electronic funds transfer at point of sale is gradually reducing the use of ATMs. The human condition is such that human beings are double-coded. They see themselves through their

relationship with other human beings. They place great value on inter-subjective relationships. At the same time, human beings create their own artificial environment. This is a 'second nature', consisting of made objects and artifices.¹⁵ It is composed of material items, buildings, tools and machines. Human beings surround themselves with objects. They make, buy, use, love and appreciate objects. They inhabit a world of objects. This world is a second nature, an artificial nature that complements the first nature of plants and animals.

Human beings have a creative impulse. They like to give form and shape to things. They husband animals; garden plants and flowers; hammer wood; bolt steel; arrange pixels; code bits and bytes. This shaping or forming impulse is closely connected to the human identification with the symmetries, boundaries, cycles, waves and proportions of nature. In making beautiful things that are also useful, nature is recreated in a second nature, the object world of humankind. Cities, buildings, tools, machines and personal artefacts all belong to this object world. This explains the great affection individuals show towards trains, planes and cars, or their computers and mobile phones. This does not detract from the pleasure they have in interacting with other human beings. The object-world and the subject-world are not mutually exclusive. So auto-industrialism is not a threat to human relationships any more than the automobile was. This does not stop technophobic literary forms from imagining otherwise though. A civilization that loves its machines also loves to depict those machines rising up and taking over. But aside from cultural projections of fears and anxieties, auto-industrialism does not imply human alienation. Rather it does what all automation does: it eliminates routine work, both manual and intellectual. As interactions with machines increase, individuals still have intense personal interactions with others: with family, friends and acquaintances.¹⁶ But they opt out of other more procedural, instrumental and mundane interactions with their fellow human beings. In place of those prosaic exchanges, they instead opt for human-machine transactions because of their convenience and lack of pressure.

The volume of human-machine interactions is rising. Self-organizing machines are becoming increasingly common in everyday life. There are many examples of these: house vacuuming robots (Roomba), companion bots (Jibo), bartending bots (Monsieur), the multilingual retail bot (OSHbot) along with algorithm-driven market trading, automated intelligent searching of legal and medical records, autonomous weapons systems (Super Aegis), facial recognition surveillance software, market and opinion survey robocalls, voice recognition validation software, robotic healthcare assistants (Baymax) and self-driving vehicles. American's Defence Advanced Research Projects Agency was crucial

in the development of the Internet. Now it is developing the robotic battlefield. Japan today plans to take on China industrially with a massive program of robot factories. Foxconn, the giant Taiwan-based iPhone manufacturer, projects its own program of automation. Mainland China meanwhile is beginning a vigorous transition from factory labour to robots.¹⁷

How many commercial truck drivers or taxi drivers or fork-lift drivers will there be in 30 years' time? Likely, not many. The mining company Rio Tinto already operates autonomous haulage vehicles, drillers, ore dumpers, stackers and reclaimers in its mines. Farm robots will weed, prune, monitor produce, check on herds and harvest crops. The globalization era saw the export of traditional manufacturing jobs from developed to developing countries. Skilled jobs were replaced with service jobs. Now service jobs are being automated. Lowe's, the US hardware retailer, is trialling humanoid robot shop assistants. Japan plans robot nursing home assistants to cope with its aged population. Health assistants are one of the prime projected employment growth areas in the next 20 years. But what if these jobs are gradually replaced by machines? There are lots of long-term scenarios for wealth creation but few for job creation. Keeping in mind that jobs are a subset of occupations, it may turn out in the future that job creation is gradually overtaken by occupation creation in the self-employed sector.¹⁸

Peopleless robot factories and driverless vehicles will transform labour markets. Many existing jobs will be eliminated. This applies not only to blue-collar work but also to pink-collar, white-collar, service and professional work. Low-level medical diagnoses, preparation of tax returns, paralegal document searches and university essay marking in the foreseeable future will be automated. The same is happening already to the work of book-keepers, marketers and meter readers. Self-service is taking over airline check-in and supermarket check-outs. Any formula task can be automated. A lot of professional operations, as we are discovering, are just that: formulas. Some professional disciplines are finding that they cannot match the power of big data processing. Pattern recognition software for instance will replace much of radiology diagnostics.

These are new developments but in a way also very old ones. The mix of computing, digital sensing and robotic handling on a mass scale is new. Yet the underlying driver of this, automation, is a fixture of industrial societies. It is a function as much of the essential continuity as it is of the perpetual change of industrial societies. It represents the essence or nature of industrialism. Automation is a fixity amidst technological mutability; a variable invariant. Through more intense and less intense periods, it substitutes machines for hand, back and brain power. Today the spread of new generations of self-organizing

machines is starting to have a visible impact on labour markets. This impact is being felt not just in one or two job market segments but rather across the full spectrum of service, blue-collar, white-collar, pink-collar, professional and para-professional work. The graduate employment market accordingly is shrinking.¹⁹ The mass demand for individuals with undergraduate degrees is declining relative to the demand for high school graduates and university postgraduates. The structure of the labour market is being reshaped. This is a consequence of long-term technology and employment trends. These trends reflect the shift from post-industrialization to auto-industrialization.

THE END OF POST-INDUSTRIALISM

Post-industrialization represented a tectonic change in the structure of employment. In the 1970s, Australia manufactured 500,000 cars annually and employed 90,000 workers in the auto industry. As of 2017 it will produce zero cars. In the 1970s and 1980s across the OECD, manufacturing industries declined. Factories were shuttered or relocated abroad. Middle-income blue-collar work shrank. The public policy question then arose: what would replace these jobs? The answer was white-collar 'knowledge' work. Universities and colleges, it was thought, would educate the 'knowledge' workers of the future. What was the effect of that? Today a quarter or more of graduates never work in a job that requires a degree. As the size of the university and college sector grew so did the number of graduates working as taxi drivers.²⁰ Human capital economics assumed that education determines economic outcomes. If anything, the reverse is the case. As enrolment numbers at universities expanded, the relative size of median graduate salaries shrank.²¹ Since 1990, the relative number of middle-income salaried jobs has shrunk as well.

After 1970, in the leading industrial nations the scale of manufacturing decreased. The contraction of manufacturing was driven by industry economics. Cheap labour abroad beckoned. Alternatively when factories stayed put, machines replaced labour. Work was automated. This reflected the logic of industrial society which is to substitute machines for routine labour. Post-industrialization coincided with a political and cultural shift in major states. Social expectations were transformed by big government liberalism. In the post-industrial era, the focus of political attention shifted from production to distribution. The welfare state burgeoned. Crony capitalism multiplied. Grants and allocations captured the social imagination. Government debt and deficits increased. This debt was illusory money. It was easy to obtain but difficult to pay off.

The long-term consequences of post-industrialization were in many respects sullen. In advanced economies, the great wealth creation phase of the 1950s and 1960s stopped. Long-term real income and GDP growth flattened. Pundits promised that the workforce would become populated with glamorous highly educated symbol-users. University enrolments exploded. The class of public sector professionals and administrators swelled. The focus of post-industrialism was document production and rule generation. Fifteen percent of the GDP of advanced economies today is consumed by regulation. Even then not everyone can be a document fabricator or rule processor. The alternative usually is a service job. Today graduates wait tables and drive taxis. Increasing numbers of people opt out of work altogether into government disability payment schemes.²² In the post-industrial era the moral crux of modern life, the work ethic, came under mounting strain.

Today, for the first time in 40 years, there are tentative signs of a reaction against this. Post-industrialism has run its course. Twentieth-century Keynesian economics supposed that employment was a function of economic demand and that such demand could be stimulated by government spending.²³ Time and again that has proved not to be the case. This is because economies are foremost a function of supply and production rather than demand and distribution. If economies fail to supply appealing goods, they falter. The popular music industry boomed in the 1960s and 1970s when it produced interesting artefacts. It is desultory today by comparison because it no longer does that. At times it blames the Internet for its woes. But the real cause of its decline is that it is one among many industries in the post-industrial period that lost its capacity to produce exciting or attractive goods.

Over the long run the wealth-creating power of modern industrial capitalism has been remarkable. What has driven it has been the ability to create ingenious new products of lasting value, interest and utility. Equally remarkable have been the canny ways devised for producing these products. The first industrial revolution gave us the putting-out system (cottage industry). The factory system followed. After that we had the production line, the firm and the modern organization. The least effective of all of these was 'the organization'. It dominated the post-industrial information age. This was the era of electronic documents and office software. While its advocates periodically promised the coming of the lean corporation, the principal legacy of IT in the post-industrial period was the relentless expansion of private and public bureaucracies. These produced mountains of unproductive intangibles — reports, audits, assessments, reviews and regulatory frameworks. This documentary megalith was reflected in declining productivity and shrinking real wealth creation across the era.²⁴

From 1970 to 1990 the post-industrial script outwardly looked credible. The classic middle tier of industrial skilled work shrivelled but low-income service work, middle-income administrative and sales work and high-income high-tier professional work grew. Yet under the surface, another story began to take shape. This centred on the phenomenon of 'job polarization'.²⁵ This development began to crystallize in 1990.²⁶ It was first defined analytically in 2003.²⁷ Job polarization means the shrinking of middle-tier, middle-income work relative to low-income service work and high-income, high-end professional work. This is a function of technology. Both manual and office work are affected. Computerization today is eliminating routine administrative, service and retail work at an accelerating pace. Robots are replacing machine operators, assembly and production workers, miners and wharf labour. The mid-tier of occupations is contracting. At the same time, demand for low-skill service work has grown. A particular kind of service work (in security, cleaning, care and hospitality) requires manual dexterity. Such work (so far) has been resistant to automation. Demand for it has grown along with the demand for high-skill professional abstract labour that involves significant elements of interpretation, invention, judgement or creativity. The labour market in advanced economies is starting to look like an hour-glass, with growth at the top and the bottom and shrinkage in the middle.

As a result of job polarization, the second half of the post-industrial era (the period between 1990 and 2010) started to generate an employment structure that was the opposite of what post-industrialization was meant to achieve. The effects of this incipient reversal have become clearer over time. Graduate employment in low-skill service occupations has grown. The premium received by young adults getting degrees (today 30 percent or more of them) has shrunk. In the 1950s, college graduates in the United States earned 2.3 times that of high school graduates. Now they earn 2.5 times a person with 8 years only of education. In many advanced economies, median income has flattened while the career income of the 10 percent of the young adult population who today undertake some kind of postgraduate degree has increased.²⁸ The percentage of the population in 2005 getting PhDs was about the same percentage of the population getting undergraduate degrees in 1955. Large numbers of young adults now go to university. However, the principal beneficiary of contemporary higher education is the small postgraduate class whose labour is abstract. Demand, as expressed in income, continues to grow in the case of the relatively small 10 percent of the workforce whose labour leans heavily on calculation, interpretation, judgement, problem solving, reflexivity, coordination, ingenuity, resourcefulness, imagination, originality, innovation and creativity. In the

near run, over the next decade demand is projected to be especially high for calculation-based expertise in business and financial operations, mathematics and computing. In contrast, the demand for qualified mid-tier salaried employees doing tasks that are well-defined, organized into clear analytical steps and firmly demarcated from other tasks — in short that are recurring, routine and methodical — is shrinking. Machines are replacing people in these roles.

Where post-industrialism eviscerated manufacturing work in advanced economies, auto-industrial technologies are now eliminating routine work.²⁹ This includes routine manual, office, sales, service, para-professional and low-end professional work.³⁰ As this technology wave further unfolds over the next 10 and 20 years, much existing routine mid-tier pink-collar, white-collar and ancillary professional work will disappear. This has multiple implications. The need for mass higher education is shrinking. The world of 'the office' and the 'sales department' staffed by middle-income workers with generic university degrees, doing defined repetitive tasks, is collapsing.³¹ Computerization and automation are replacing these kinds of employees.³² Thirty to forty percent of current occupations will be significantly affected by computerization and automation in the next 10 years. In effect, a net 15 to 20 percent of current jobs will disappear. The era of large-scale routine knowledge work is powering down. This change is occurring persistently on a large scale and over the long term. As manufacturing work in the 1970s was automated and offshored, routine office, sales and para-professional work is similarly being automated or offshored.

By 2045 few mid-tier 'knowledge jobs' will be left. Whether for society this means structural unemployment or underemployment or else different kinds of occupation at this point in time is unclear. Mid-tier wage-and-salary work in accommodation, food, transport, real estate, retail sales, wholesale, manufacturing and mining will be reduced by automation. The prospect of alternate wage-and-salary employment in new labour-intensive industries appears slim though demand for certain kinds of dexterous manual occupations is growing not declining. Auto-industrial technologies will spawn distinctive occupations. Yet it is unlikely that these will generate the multiples of the kinds of mid-tier wage-and-salary jobs that early- and mid-twentieth-century manufacturing industry did in the major economies of the time. The foreseeable effect of auto-industrialization will be the further reduction of mid-tier wage-and-salary employment.

Does this then mean high rates of unemployment? This is unlikely to be the case in societies with aging and shrinking populations that are prepared to restrict the flow of migrants into their workforce. In such cases, automation and robotics will simply replace persons retiring and exiting the workforce. Furthermore automation will not affect all occupations. Demand for manually

dextrous service work that robots (yet) cannot do and for high-end abstract professional labour foreseeably will be sustained and conceivably will even expand. Current American 10-year projections of labour demand indicate near-term high growth in financial management, health, construction and personal services. The latter three include considerable demand for persons with high school-only qualifications.

Also notable is a long-term trend for individuals in major economies to generate income from capital rather than labour. Capital work has partially replaced wage-and-salary work. The self-employed sector including sole traders and partnerships has been growing over the long run. This shift is subtly reshaping the nature of work and occupations. The trend for 'income from capital' to grow relative to 'income from wage labour' began in the 1950s. It accelerated in the 1970s. It appears that it will persist, deepen and intensify in the foreseeable future.³³ This means that if there is a future expansion of mid-tier occupations these will most likely be sourced from the self-employed workforce. Demand for entrepreneurial nous is replacing demand for labour skills. Salaried work is declining and capital work is increasing.

An analogous shift is reflected in the behaviour of traditional firms and their hiring practices. Around 2010 a new company hiring trend began to crystallize.³⁴ This is a preference for employees with a mix of digital know-how, agility, creativity, entrepreneurship, problem solving and negotiating ability.³⁵ If we add to that list additional traits — like dexterity, adroitness, nimbleness, and a capacity to decipher, elucidate, unravel and decode — a picture starts to emerge of the nature of the auto-industrial era employee.³⁶ If a short-hand term is needed to sum up auto-industrial work, it would be problem solving. It does not matter whether we are talking about manual, office or professional work, problem solving stands in contrast to the processing fixation of post-industrial work. Post-industrialism was built on a workforce engaged in routine detailed step-by-step process and procedure. This type of work followed well-defined pathways. If in the future machines increasingly do this kind of path-dependent work then what remains is nimble work. In the case of nimble work, tasks are not well defined, predictable or well rehearsed. This is irrespective of whether the task is physical, mental or both. Nimble work requires the ability to change orientation swiftly and initiate unpredicted or unusual sequences of actions. Metaphors of intellectual and physical swinging, spiralling, flipping, gyrating, rotating, turning and self-starting apply to this kind of work.

Self-starting, problem-solving and adroit behaviours have increasing value in the auto-industrial age. Self-management in place of other-directed decision making is at a premium. But not all of contemporary culture is in sync with

this — far from it. Take the case of higher education. In 2015, 20 percent of UK university students surveyed said that they wanted to work for a large company and 34 percent for a medium-sized company. Only 6 percent of British students said they wanted to run their own business and only 10 percent wished to work for a start-up company.³⁷ Yet the underlying logic of the auto-industrial age favours small start-up companies, partnerships and sole proprietorships.³⁸ Most net new employment today is generated by small businesses that are less than 5 years old with less than 250 staff and especially those with less than 50 staff.³⁹ Auto-industrialism is in step with the larger historical trend for 'income from capital' to grow relative to 'income from wages and salaries'.⁴⁰

While auto-industrialism favours self-starters, post-industrial culture does not.⁴¹ This means that inherited social expectations are now at odds with contemporary social trends. Received expectations have been shaped by five decades of post-industrialization. The larger part of the twentieth century was dominated philosophically by state socialism. Government employment in major economies grew significantly. After 1970, a shift occurred. This was the era of post-industrial neo-socialism and social liberalism. The government sector continued to grow but this was matched and exceeded by the growth of the broader taxpayer-subsidized education and health sectors. Governmental, education and health lobbies all relied on something called 'knowledge' as their legitimation. These voluble interest groups each claimed they produced public goods or public benefits that embodied 'expertise', 'intelligence', 'know-how' and 'information'. The reality though was somewhat different. What taxpayers paid for on an ever-escalating scale was process and administration. Ever larger portions of perpetually mounting education and health spending was not for education or health functions in the literal sense but rather for the bureaucratic processes and procedures that surrounded them. Intelligence was a euphemism for officialdom. The documentation of process was knowledge. Since the late nineteenth century, government service was legitimated even sanctified by claims to special knowledge or expertise. Such legitimations were intended to incite awe and mystery. The claim of government administrators to special knowledge was underwritten in the nineteenth century by civil service examinations. In the twentieth century, the university degree replaced the legitimating function of the examination. As government grew, followed by public sector education and health, administration grew. Armed with university qualifications battalions of administrators, officers, supervisors, managers, directors and executives populated the swelling ranks of education, health and government systems. They endowed these institutions with an aura of indispensable self-importance.

Auto-industrialization represents the end of the post-industrial era. The age of the government, health and education juggernaut is over. This is not for ideological or political reasons. In the 1980s, there was a period when the post-industrial expansion of the public sector and public subsidies was questioned, mainly in the Anglosphere. But this affected only the rate of expansion of the public sector. By the late 1990s and 2000s, the expansion was redoubled. Taxpayer-funded or -subsidized jobs for teachers, nurses and care workers boomed (the latter pushed along by aging populations).⁴² Many expect this trend to continue in the future on the grounds that these are high-touch occupations immune from automation.⁴³ This assumption though is questionable. Digitization offers serious prospects for the semi-automation online of higher education.⁴⁴ The 'do-it-yourself university' utilizing the vast store of open source content accessible on computers and phones has overtaken the historic function of adult education. There are a variety of ways of thinking about this. One is self-education. Autodidactic models are already common in the IT industry. We will likely see the spread of self-education to other sectors. One of the keys to this is competency-based degree-granting. This requires reputable examining bodies to offer serious testing of competency leading to a degree but without all the baggage of classes, tuition costs, campuses and car parks.⁴⁵

A person who is disciplined and motivated does not necessarily require any more than the unlimited resources of the Internet to learn and a rigorous independent examining body in order to acquire a degree that has vocational power and credible standing. In truth, many of the best minds are self-taught whether they attend classes or not.⁴⁶ For those who are less autodidactic in spirit, the degree-granting 'platform university' (with automated administration, micro-campuses, online delivery and third-place meet-ups in disperse locations) is another conceivable option on the horizon.⁴⁷ Robotics will deliver much in the way of rote learning technology in the same way in the 1970s the digital calculator replaced the manual slide rule. The patience of the robot in coping with the slow learner far exceeds that of any human being. Similarly in care and nursing, the scope for robotic care, diagnostic aids and self-monitoring is large. In occupations like teaching, nursing and care, it is often underestimated how much of the work is routine, repetitive and how much of it requires the kind of infinite patience that human beings lack.

Computers and robots are well suited to doing repetitive tasks. Consequently machines graced with various kinds of artificial intelligence (AI) have no better or more plausible application than in government. The scope that exists for shrinking government by automating it is enormous. Yet the nature of the state is such that it is always disposed to increase the size of officialdom rather than

decrease it. This implies that the automation of government administration will be resisted. 'Jobs' will be the cry; 'you are replacing good jobs with machines'. Indeed so, for that is the nature of industrial societies. The question is whenever jobs in a society are lost whether different kinds of occupations will arise to replace what has gone.

There are varying scenarios concerning this. One, the optimistic scenario, says that overall technological change creates more jobs than it destroys.⁴⁸ That does not obviate the depth of change, though. In industrial societies even over relatively modest historical intervals, the elimination of jobs is quite remarkable. In 1870, 50 percent of jobs in the United States were in agriculture; by 1900, that figure had fallen to 38 percent. Today the figure is 2 percent. Robotics will soon transform the remaining areas in agriculture where work is still performed by hand. Automation and mechanization are not new phenomena. They are part of the nature of industrialism. In an industrial society machines regularly replace repetitive work of all kinds — and have done so since the eighteenth century when industrial machines first appeared. Human-machine interaction is an essential part of living in an industrial society, whether the machine is a train, an automobile, an airplane, a computer or a robot.

A second, more sceptical scenario suggests that the first scenario was true until the post-industrial era but since then a shift has occurred. Either fewer jobs or fewer mid-tier jobs have been created; unemployment is disguised by the proliferation of persons on disability benefits or the decrease in labour market participation. Major employers in new industries like IT employ far fewer people than large employers did in the era of classic mass manufacturing. In response to this a third, more optimistic scenario says that the second scenario is true but is offset by self-employment that is growing relative to salaried employment. The third scenario takes issue with technological pessimism and with knowledge economy boosters alike. The tendency of technology change to stimulate basic fears has been long evident. Dark science fiction fantasies seem to follow the advance of computerization and robotics. Consequently, we will have more stories about cyborgs that have feelings, go on rampages, cause chaos, feign being human, kill us, meld with human beings, self-replicate, become conscious and eventually replace human beings.

In a more prosaic vein, we will also have overexcited depictions of future mass joblessness. These will try and induce us to adopt guaranteed minimum income schemes.⁴⁹ These schemes are designed to ensure that everyone has a basic income whether they work or not.⁵⁰ They are specious. The modern welfare state already has endless schemes that guarantee income; all of these programs ironically though are dependent on the continued growth of wealth

itself, in turn, dependent on technological development. Portrayals of mass technological unemployment, like the rise of Skynet, the conscious AI in the *Terminator* movie, tap human anxieties in industrial societies. This does not make them anything more than fictions.

The future looks rather more enticing than the pessimists suggest. Unconsciously they wish for a kind of neo-feudal welfare state. The state they envisage is populated by workless masses who live on minimum incomes. The machines have taken all the jobs. Income is transferred by a benevolent state elite from the technologically crafty corporate elite. Whether this is depicted in dystopian or utopian terms, or both, the instinct is neo-patrimonial. The morbid vision of mass technological unemployment is a hook upon which to raise up, yet again, another client-patron model of society.⁵¹ This vision seems ineradicable, whether it is the ancient Roman dole, medieval feudalism, modern socialism, post-modern rent seeking or auto-industrial minimum income schemes. That said, even if (as probable) mass technological unemployment does not eventuate, far-reaching changes in the character and type of employment are on the cards. Tomorrow will not be business-as-usual. There are major structural social changes afoot. These involve the reshaping of occupational structures, the nature of work, the relation between capital and labour and the relation between human beings and machines. This social reshaping will be deep-going, confronting and painful. It will challenge many cherished expectations. It will demolish many truisms about work and wealth. It will upset many people. Welcome to the auto-industrial age.

NOTES

1. Some like Schwab (2016) have called it a fourth industrial revolution.
2. Chan (2016).
3. Deloitte (2014: 27).
4. Forty percent of London Internet sales are 'click and collect'. Though only a small portion of overall sales, they are increasing at 30–40 percent a year compared with the less than 3 percent growth in total retail sales. Deloitte (2014: 27).
5. Skorupa (2013); Joe (2013).
6. Telegraph Reporters (2016).
7. Models such as 'research online buy offline' (robo) and 'click and collect' are gradually replacing the conventional store sales formula.
8. The United Kingdom between 2001 and 2014 lost 72,000 retail cashier and check-out jobs and 69,000 wholesale and retail shopkeepers and proprietors (Deloitte, 2015a: 7).
9. Aided by online comparisons with other products and retailers as well as online reviews of products by other shoppers.

10. Centre for Retail Research (2015).
11. The online retail market share in Europe and Australia is in the 7–10 percent range.
12. Murphy, 2015b.
13. On the history of the idea of social laws, see Brown (1984).
14. As with all social shifts, there are contrary forces at work. Online anonymity is conducive to social distance and independence. At times though, it also elicits furious umbrage, foot-stamping and shouting designed to put pressure on others.
15. Murphy and Roberts (2004: 83–6) and Murphy (2014b).
16. This does not guarantee that in every instance persons will always prefer other people over machines. Disengaging from others is as old as the human species itself.
17. 'More than 100 industrial robots have been installed at a zero-labor factory that is being built in Dongguan, a major manufacturing base in Guangdong province. The construction of the factory, the first of its kind in the province, marks an important step for the "robot assembly line" strategy that is being followed by the province as it tackles a severe labor shortage. Chen Qixing, chairman of the board of Guangdong Everwin Precision Technology, said 1,000 robots will be used in the first phase of the production facility. "The use of industrial robots will help the company to reduce the number of front-line workers by at least 90 percent," Chen said. "When all the 1,000 industrial robots are put into operation in the coming months, we will only need to recruit fewer than 200 software technicians and management personnel"' (Zheng, 2015).
18. As James Bennett and Michael Lotus (2013: 186) observe: 'the entire concept of a "job" is going away. At the time of the Founding, most Americans did not have jobs. There is no reason to think most Americans in the future will have jobs, primarily working at the direction of others employing capital owned by others. Americans are not yet remotely prepared for this shift, either institutionally, or psychologically.'
19. In an interview in 2014, Catherine Livingstone, the President of the Business Council of Australia, said that Australian universities were enrolling too many domestic students. Ian Young, Vice Chancellor of the Australian National University, added that Australia's major research universities would enrol fewer students in the future if given the chance (Gilmore and Knott, 2014).
20. Murphy (2015a: 170).
21. Murphy (2015a: 192–201).
22. Since 1990, the share of the American working-age population that receives disability benefits has doubled, increasing from 1 in 40 persons to 1 in 20 (Boccia, 2015). An aging population and an older retirement age explains a small portion of this shift. More significant still is the combination of broader definitions of disability, looser application of entitlement criteria and a growing social readiness to see the long-term receipt of disability benefits as an alternative to paid work. As American industries have got safer, the portion of the population receiving disability benefits has grown.
23. Spending spurred the rise of the grant-request industry (lobbies and pressure groups) and grant-funded industries. Both distorted sound economic behaviour.

24. Gordon (2016) characterizes this as a 'slow growth period since 1975' (averaging 1.2 percent p.a.); technologically, he avers, 'we have achieved relatively slow progress since 1970' notwithstanding the spread of computers. 'The period 1870 to 1970 was a special century when it comes to technology-driven productivity increases (averaging 2 percent p.a.). The century was unique in human history and unrepeatable because the achievements of the era could only happen once. The combination of electricity, the internal combustion engine, water utilities, and the conquest of infant mortality made this an exceptional hundred years, the like of which we will not see again. In contrast, computing and the Internet are not nearly as significant although productivity did accelerate briefly in the dot.com decade between 1995 and 2005 as a consequence of information technology.' The counter-argument to this Murphy (2015a) agrees that a slowdown in innovation and growth occurred after 1970 but that this was the result of post-industrialization which was unable to deliver significant productivity increases in service industries including office industries. Rather than becoming more efficient, office work became relatively more inefficient as organizations became increasingly bureaucratized.
25. Autor and Dorn (2013) and Autor, Katz and Kearney (2006).
26. More sceptically, Schmitt, Shierholz and Mishel (2013) argue that labour market job polarization has been going on since the 1950s. Their thesis is that mid-skill occupational employment has declined and high-skill occupational employment has increased in every decade since the 1950s while demand for high-wage occupations fell in the 2000s.
27. Goos and Manning (2003) and Autor, Levy and Murnane (2003).
28. Murphy (2015a: 197–8).
29. Frey and Osborne (2013, 2015).
30. Autor, Katz and Kearney (2006) and Autor and Dorn (2013).
31. In the United Kingdom, between 2001 and 2014, 58,000 business sales executive jobs were lost along with 204,000 personal assistants and secretaries and 108,000 typists and keyboard occupations (Deloitte, 2015a: 7).
32. Frey and Osborne's research for Deloitte (2014) on the UK workforce in the next 10–20 years projects a large decline in white-collar office, retail and service jobs (figure 2). In the period 2001–13 in London, the number of library assistants, sales occupations, record assistants, travel agents, counter staff, PAs and secretaries and bookkeepers declined sharply (figure 4).
33. One tacit advantage of this accrues to countries with aging populations. As people age they exit the workforce, no longer earning income from wages and salaries, but if they have capital assets (stock portfolios, rental properties, etc.) they will continue to generate income. This corrects for the problem that Robert Gordon (2016) points to that, namely that with an increasing percentage of the population out of the active workforce in aging societies, future labour productivity gains (measured as increased output per employee per hour) have to be spread among a greater number of people (via wages and transfer payments) as labour retires. However, productivity is not only

the productivity of labour but of all the factors of production. The return on capital investment is also a means of spreading the benefits of productivity increases. In contemporary aging societies, if the same output can be produced with less labour, the effect will be increased productivity whose benefits are expressed not only in real wages or tax-derived transfer payments but also in the return on capital investments.

34. Kern, 2010.
35. Deloitte (2014, figure 12).
36. Not as well understood is the correlated need of management to be less risk-averse, less rule-driven and less micro-managing.
37. Barea and Vasudeva (2015).
38. 14.7 percent of the UK workforce is sole proprietors; in Australia, it is 9 percent. Eleven percent of the US workforce is sole proprietors, working more than 15 hours a week and many working more than 35 hours a week; another 7 percent work less than 15 hours a week (Johnson, 2013; MBO Partners, 2014; Committee for Economic Development of Australia, 2015: 180). This is a contented workforce. Fifteen percent of US sole proprietors who work more than 15 hours a week earn an income of \$100,000 or more a year (MBO Partners, 2014: 4, 5, 8, 12).
39. Stangler (2010, figures 3–5). This phenomenon is echoed by the UK IoD99 small business enterprise culture peer network. Since 1990, in the United States big business eliminated four million jobs and small businesses have added eight million new jobs. Data source: US Small Business Administration.
40. This trend is reflected in the rise in the numbers and income of sole proprietors. In the United States in 1995, there were 16,423,000 sole proprietor tax returns. In 2012, the number was 23,426,000, an increase of 42 percent in 18 years. Over the same period, the population of the United States increased by 22 percent only. The total business receipts of sole traders grew from \$807 billion to \$1,301 billion, outpacing inflation by 7 percent. Data source: Internal Revenue Service sole proprietorship returns 1996 and 2012.
41. It also favours persons with broad, flexible, agile talents. Post-industrialism was the age of qualifications. Auto-industrialism is the era of DIY multi-skilling. Trans-disciplinary abilities accordingly are much sought-after. From 1970 to 2000, demand for IT specialists boomed. Then the IT bubble burst. Today, where the professional market flourishes is not in traditional IT roles but in hybrid IT-business-organizational roles (Glover, 2011; Miller, 2011). Qualifications are anchored in disciplines; the DIY capability to synthesize elements of business, science, technology and the arts is closer to the inward spirit of auto-industrialism. The DIY talent is related to creative ability. Both take what is set apart and fuse it together. See, e.g., Dyer, Gregersen and Christensen (2011: 41–64).
42. In the United Kingdom, jobs for teaching assistants, secondary, primary and nursery and other educational professionals grew by 235,000, 131,000, 110,000 and 113,000 respectively; jobs for nurses grew by 186,000; and jobs for care workers and home carers grew by 271,000 (Deloitte, 2015: 7).

43. This assumption is made by Frey and Osborne (2013, 2015), whose influential analytic work provides the best current projections of which occupations will be least and most affected by automation. They assume that teaching, nursing and care occupations will be largely immune from automation.
44. Kamenetz (2010); Reynolds (2014); Murphy (2016).
45. Championed by Wisconsin governor Scott Walker, the University of Wisconsin began offering competency-based bachelor's degrees in 2013 (Porter, 2013), while Dennis (2014) notes that the multi-state Western Governors University 'has awarded college degrees based on assessments of learning since 1997'. These and other recent initiatives at Purdue University and University of Michigan seem largely motivated by the interest in having students with some existing traditional degree credit complete their degrees rather than a beginning-to-end system of DIY education. Nonetheless, they provide the basis for fully autonomous higher education.
46. Those who did not go to a university or college include Richard Branson, Michael Dell, James Cameron, Benjamin Franklin and Abigail Adams. <http://selfmadescholar.com/>
47. Murphy (2016).
48. Stewart, Debapratim and Cole (2015).
49. An N-gram search shows that the concept of a guaranteed minimum income had a brief spectacular career between 1962 and 1972 and then just as suddenly fell out of favour. The reason for its 1960s' popularity was that it promised an income separate from employment in an era of escalating automation.
50. Ford (2015). Sachs (2015) similarly presses for the redistribution of income in order for us to live happily with robots. Sachs, Benzell and LaGarda (2015) argue that the increase in robotic productivity will lower wages in the long run and that this 'immiserization' of labour can only be overcome through the 'redistributive policies of the state'. Megan McCardle (2013) sets out four reasons why a guaranteed minimum income will not work: (1) Take all the welfare benefits in the United States and distribute them to all 235 million adults: that amounts to \$3,000 per adult per year. Providing a viable minimum income for (say) a quarter of all adults would amount to an infeasible doubling (at least) of the welfare bill. (2) A guaranteed income would reduce the reciprocity at the heart of a functioning society by creating an entitlement without the corresponding duty to contribute. (3) A minimum income state would be a magnet for illegal immigrants seeking to receive benefits without making contributions. (4) Long-term minimum income recipients would experience difficulty re-entering the job market.
51. On the historic conflict between the patrimonial model of society and the counter-vailing model of proportionality, see Murphy (2001).