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Design Capitalism: Design, Economics and Innovation in the Auto-Industrial Age

Abstract Automation is replacing white-collar office work and non-dexterous manual work, causing major structural change in the job market. As advanced economies shift from a post-industrial to an auto-industrial model, all kinds of routine work is being replaced by machines. Mid-range job opportunities are shrinking, and labor markets are polarizing. Demand for dexterous service work nevertheless remains strong, as does demand for abstract labor working with patterns rather than with rules or procedures. Design is a mid-tier occupation that is growing rather than declining. "Design" is also a metaphor for abstract labor of all kinds; it exemplifies work that is creative, innovative, problem-solving, and reliant on judgment rather than rules. Heightened demand for abstract labor reflects the evolving nature of capitalist economies. The contribution of invention, ingenuity and imagination to the creation of economic value continues to expand. The auto-industrial era is coeval with design capitalism; together they represent a key dimension of future economics.

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Automation and the Long Stagnation

Modern capitalist economies are based on the paradox that "less is more." The art of economizing is to balance increased production with decreased labor input. A successful modern economy has high levels of productivity; it continually produces more goods and services while utilizing less labor per unit of production. But using less labor in this manner creates a conundrum: although increases in productivity make a society wealthier, if "less labor" means the net stock of work in a society shrinks, then the general level of social prosperity will reduce. To solve this puzzle, modern capitalist economies must determine how to increase productivity and wealth, whilst also ensuring that the benefits produced are broadly available through work.

Dynamic societies typically deal with this conundrum in two ways. First, they adjust the relativities between income generated by labor and capital. That is, they encourage more people to earn income from capital rather than labor, if the demand for labor declines.[1] This is sometimes called "popular capitalism". This approach reduces the reliance on wages to distribute the benefits of productivity gains, and entails more people earning income as freelancers or sole traders, in partnerships, or as owners of small- and medium-sized businesses. Secondly, dynamic societies create new economic sectors and industries. Modern capitalism is an innovation-propelled economic system: it is creative, and this creativity expresses itself in a number of ways. Productivity, one form of creativity, is based on ingenuity. To achieve more output with less input requires clever and original approaches. Devising resourceful ways of producing the same quantity of goods and services with fewer employees is an inventive form of problem-solving.

However, this is merely one example of the larger wellspring of ingenuity that successful modern capitalist economies rely upon. Indeed, they have to constantly engage in an act of double coding: reduce labor input and the time spent on coordinating labor (managing it and overseeing it) while increasing labor use by creating unprecedented kinds of industries and economic activities. Alternatively, if they cannot increase the use of labor in new kinds of industries, then they have to increase the use of capital such that, whilst fewer persons may engage in salaried work or wage work for a living, more individuals engage in "capital work" as freelancers and sole traders, or in partnerships and the like. "Capital work" represents the time that the owner of capital spends managing, coordinating, organizing, and directing an investment or business.[2]

The increase in wealth and productivity in modern capitalist economies has been dramatic over the past two hundred years. It has pulled a large portion of the world's population out of absolute poverty, and given the citizens of advanced economies a standard of living unparalleled in human history.[3] The economic advancement of the past two centuries is clearly remarkable, yet it is difficult to sustain, because by definition it requires constant innovation.

The enduring bedrock principle of modern capitalism is this ingenuity. It produces new things, which, if successful, become durable, stable, and permanent features in the lives of modern people. Often, when such things are first experienced, they feel like "the shock of the new,"[4] but what at first is astonishing eventually becomes routine. This double-edged quality of modern capitalism is one key to its success. The idea of the "double edge" is in fact very much like creativity itself. What the act of creation does is to join together what ordinarily is set apart.[5]

A core difficulty modern economies share is the need to be continuously creative, which is more or less impossible in a literal sense. This means that modern capitalism is not progressive, but rather cyclical:[6] it goes up and down and up and down, rather than operating along a straight line of improvement. When it

1 This also means reconceptualizing what capital is. As auto-industrialism grows, domestic assets are turned into capital. The private house is an example of this. The person who converts their house (for example) into a part-time Bed-and-Breakfast is converting tacit capital into active capital. This is in contrast to a person who speculates on the growth of the capital value of their house during a speculative boom. Cars, garages, rooms, and domestic tools and technologies are the basis for a growing independent (or "indie") capitalism. Each of these represents a form of sleeping capital that is awoken by owners interested in various kinds of self-employment.

2 Today the largest cohorts of sole proprietors in the United States are, in descending order of size: professional scientific and technical services (13 percent); services (12 percent); construction (11 percent); administration (10 percent); retail (9 percent); health (9 percent); arts, entertainment and recreation (6 percent). Source: Adrian Dungan, "Sole Proprietorship Returns, 2012," *Internal Revenue Service* (*IRS.gov*), accessed December 10, 2015, https://www.irs.gov/pub/irs-soi/soi-a-inpr-id1503.pdf.

3 Deirdre N. McCloskey, *Bourgeois Dignity* (Chicago: University of Chicago Press, 2010), 1–2; Thomas Piketty, *Capital in the Twenty-First Century* (Cambridge, MA: Harvard University Press, 2014), 86–90.

4 The term was immortalised by Robert Hughes in his art-critical meditation *The Shock of the New: Art and the Century of Change*, enlarged edition (London: Thames and Hudson, 1991).

5 Peter Murphy, *The Collective Imagination* (Farnham, England: Ashgate, 2012).

6 Murphy, *The Collective Imagination*, 149–92.

goes up, people expect it to keep going up. When it goes down, the same people expect it to keep going down. This ideology of progressivism is one of the chief obstacles to understanding the peculiar dynamics of modern capitalist economies. In fact, they are neither progressive nor regressive. They do not move in one direction only; they move in two directions, simultaneously. This is an aspect of the double-coding of modern capitalism.[7] Its cyclical nature is a practical form of economic dual-coding. The downturns of capitalist economies, as stressful as they might be, are essential sources of the upturns that follow them. Upturns are born of downturns, and so on. Downturns signal that a generation of innovation has exhausted its potential.

Economic downturns reduce the demand for labor. Jobs that were previously thought of as necessary are dispensed with. Once they go, they rarely return to an economy in the same numbers. Businesses and organizations discover, often painfully, that they can do more with less. They might not go seeking it, but the mechanism of economic cycles imposes efficiencies on business units. Due to the pressure of economic circumstances, a business discovers that a new generation of machines can replace the employees that must be let go when an economic cycle reaches its lowest point.

Modern capitalism is technological in nature. It is a species of industrialism. It saves on the cost of labor by using machines. Yet capitalism does not only shed labor. It also innovates by creating new kinds of work in new industries. For instance, at one time the automobile industry was a new industry; likewise the aircraft industry. At first their need for labor expanded; then, as they matured and automated, it reduced. This cycle repeats. The information technology industry in the 1980s, however, hinted at a different path. While new industries might typically increase labor demand, IT wage-labor creation might not be on the scale of the railways or automobile industry. If that was so, then the generation of capital work might prove to be as crucial as additional wage-work in fresh industries. Arguably, future employment rests as much on capital work as it does on newfound wage-and-salary work.[8] This supposes that persons switch to earning from capital rather than labor. Income of this kind includes royalties, dividends, interest, capital gains, rents, and profits. Arguably it also includes operator salaries, which are defined as business expenditure for tax purposes but are also key items of income for sole proprietors and partners. Capital work underscores modern capitalism's double-coding. It can reduce the demand for labor and increase the demand for work at the same time.

In 2008 the global economy began a long phase of economic stagnation, characterized by lower growth, lower productivity, stagnant real incomes, a reduction in economic demand, and the shedding of labor. Even in China, the most bullish of the major world economies, growth declined. The period of global stagnation was framed by a longer-run decline in productivity and shrinking rates of economic growth in major economies. This was evident well before the global downturn of 2008.[9] High rates of growth enable countries to increase their GDP per capita. They get richer. With that, social prosperity grows. Lower growth is manifest in the flatlining of real incomes, and unemployment and underemployment. One explanation of long-term multi-decade declining productivity is the growth of post-industrial service jobs in advanced economies. These have proved difficult to make more productive.[10] A hairdresser today is not much more productive than fifty years ago. The growth of the government, education, and health sectors in the post-industrial era was accompanied by a multiplication of regulations and procedures. This also stymied productivity gains.[11]

This scenario may change. While low growth is acutely visible in advanced economies today, less visible is the accelerating replacement of labor by

7 Peter Murphy, "The Enigma of Capitalism and the French Cul-de-Sac," *Thesis Eleven: Critical Theory and Historical Sociology* 124, no. 1 (2014): 71–89.

8 Doesn't this exclude the least skilled? In major economies today, even the poor and low-income classes have assets. Capital is a matter of waking assets from their slumber and putting them to work to earn income. Rector and Sheffield (2011) report that 99.9 percent of US households have a refrigerator; 98.7 percent a television; 98.5 percent a stove or oven; 87.9 percent a microwave and 84.0 percent air conditioning. The figures for poor US households are not much different: 99.6 percent have a refrigerator; 97.7 percent a television; 97.7 percent a stove or oven; 81.4 percent a microwave and 78.3 percent air conditioning. See Robert Rector and Rachel Sheffield, "Air Conditioning, Cable TV, and an Xbox: What is Poverty in the United States Today? Backgrounder #2575 on Poverty and Inequality," *The Heritage Foundation*, July 19, 2011, accessed November 21, 2015, http://www.heritage.org/research/reports/2011/07/what-is-poverty.

9 Piketty, *Capital in the Twenty-First Century*, 93–96.

10 "…productivity growth in the service sector has generally been low (or even zero in some cases, which explains why this sector has tended to employ a steadily increasing share of the workforce)." Piketty, *Capital in the Twenty-First Century*, 90.

11 Peter Murphy, *Universities and Innovation Economies* (Farnham, England: Ashgate, 2014).

machines.[12] Contemporary labor-substitution takes the form of automation, computerization, and robotics, which are long-existing technologies. Computing and robotics for example were both well established by the 1950s. In the 2010s, their labor-replacing power accelerated. This kind of long-run development punctuated by a late arriving, sharp upswing is true of many major technology impacts. Rarely are they overnight stories. In fact, automation is as old as industrialism. What is interesting about the post-2008 acceleration of automation is its focus: routine work on a large-scale, including both repetitive manual work in the case of robotics; and repetitive, white collar office work in the case of computerization. Across the medium term of ten to twenty years (2008–2030), the amount of routine work expected to be replaced is very large indeed.[13] Thirty-to-forty percent of existing jobs will be affected in major ways, suggesting that, in net terms, as least 20 percent of existing work will be completely eliminated.

The process of reducing routine work has been going on beneath the economic surface in advanced economies since 1990.[14] In each succeeding cyclical downturn since then, another portion of the total volume of repetitive work has been replaced by machines. This labor-substitution was disguised by the simultaneous growth of government and corporate regulation. Productivity gains through automation were negated by the post-industrial expansion of private and public bureaucracies. As government, health and education sectors, and corporations became more efficient, they also became less efficient. In the 1980s, socialism as political idea collapsed in many countries. After that, though, regulation flourished. The aggressive expansion of regulation in advanced economies generated routine work functions. Checking, auditing, reviewing, inspecting, assessing, appraising, and examining became the primary growth industry of the 1990s and 2000s in major economies. As this was happening, technology was being developed that would eventually automate these functions. Today, online processing of routine customer applications by government is one-thirtieth the cost of performing the same operation in-person, face-to-face.[15] Offshoring the application process is, by comparison, only one-fifth of a face-to-face transaction. Consequently, the balance between the multiplication of routine functions and their automation is now shifting decisively in favor of automation.

In economies like the United States, automating routine work has produced the phenomenon of "job polarization." Jobs at the top and bottom ends of the work-skill spectrum have grown since 1990, while demand for routine mid-tier, mid-skill work, notably in offices, has declined – and is projected to decline further.[16] The result has been a hollowing-out of middle class jobs with the prospect that many more such occupations will disappear over the next two decades. Since 1990, low-income service work has been less affected by automation. It is often not routine enough to be replaced by the current generation of machines. But with rapid advances in robotics in the last decade (2006–2016) that is changing. Wider and wider swathes of routine work of all kinds, manual and non-manual, are projected to be replaced by machines in the near- and medium-term future. The scale of replacement is massive.

The execution of a routine task involves repetitious and well-defined steps that can be easily mimicked by a computer algorithm. Once that has been written, the work can be done by a machine or machines. Progressively, software is replacing mid-tier accounting, HR, payroll, tax agent, travel agent, clerical processing, and numerous similar functions.[17] As machine intelligence has improved and sensor technology has grown cheaper and better, advances in autonomous robotic systems are replacing ever-increasing numbers of mobile and manual operations with machines. Autonomous cars, military vehicles, and aircraft along with domestic, factory, and hospital robot assistants are appearing. In twenty years' time, road and

12 David H. Autor and David Dorn, "The Growth of Low-Skill Service Jobs and the Polarization of the U.S. Labor Market," *American Economic Review* 103, no. 5 (2013), 1553; *London Futures. Agiletown: The Relentless March of Technology and London's Response* (Deloitte, 2014), accessed November 21, 2015, http://www2.deloitte.com/uk/en/pages/growth/articles/agiletown-the-relentless-march-of-technology-and-londons-response.html; Nir Jaimovich and Henry E. Siu, "The Trend Is the Cycle: Job Polarization and Jobless Recoveries, No. w18334" (working paper, National Bureau of Economic Research, 2012), accessed November 21, 2015, http://www.nber.org/papers/w18334.pdf.

13 Carl Benedikt Frey and Michael A. Osborne, *Technology at Work: The Future of Innovation and Employment* (Oxford: Oxford Martin School, 2015), accessed November 21, 2015, http://www.oxfordmartin.ox.ac.uk/publications/view/1883; Carl Benedikt Frey and Michael A. Osborne, *The Future of Employment: How Susceptible are Jobs to Computerisation?* (Oxford: Oxford Martin School, 2013), accessed November 21, 2015, http://www.oxfordmartin.ox.ac.uk/publications/view/1314; Committee for Economic Development of Australia (CEDA), *Australia's Future Workforce?* (Melbourne: CEDA, 2015), accessed November 21, 2015, http://www.ceda.com.au/research-and-policy/policy-priorities/workforce.

14 Jaimovich and Siu, "Job Polarization and Jobless Recoveries"; David H. Autor, Frank L. Levy, and Richard J. Murnane, "The Skill Content of Recent Technological Change: An Empirical Exploration," *Quarterly Journal of Economics* 118, no. 4 (2003): 1279–1333; David H. Autor, Lawrence F. Katz, and Melissa S. Kearney, "Measuring and Interpreting Trends in Economic Inequality: The Polarization of the U.S. Labor Market," *American Economic Review Papers and Proceedings* 96, no. 2 (2006): 189–94.

15 *Digital Government Transformation* (Deloitte, 2015), 24,

transport systems will be largely driverless and operator-less. People-less systems of factories-warehousing-transport-retail lie not too far in the future. For the moment, robots are still poor at carrying out tasks that involve high levels of manual dexterity. With time the dexterity of machines will grow.

The phenomenon of machines replacing labor belongs on what could be called the "disruptive" side of capitalist innovation. Disruptions contribute to novel business models and product development, seek to make the production, distribution and allocation of products and services increasingly efficient, and to make the use of such offerings more pleasurable to a greater number of people. Disruptions are typically made possible through the use of digital technologies. By accelerating the pace at which they replace routine work with machine intelligence, advanced economies are swiftly moving from the post-industrial to the auto-industrial era. The post-industrial era was characterized by the expansion of "knowledge work": mid-tier, mid-skill, university-qualified, information processing office-based work. The expansion of such work is over. In London, between 2001 and 2013, 65 percent of library assistants, 48 percent of counter clerks, and 44 percent of PAs disappeared.[18]

Technology innovation "disrupts" by enabling the performance of existing functions more cheaply, quickly, and flexibly. The other side of the capitalist economic cycle is, by contrast, "constructive," and involves the formation of new industry sectors, new values, and new demands. Historically, the electricity utility industry, the railways, the automobile industry, and so on, are examples of this. What such constructive innovation brings with it is not the replacement of labor by machines, but rather the invention of newfound work. This is separate from the creation of fake "make work" by governments eager to quell social anxiety about automation. Modern economies invent work as well as replace work by machines. New job categories are being continuously created. That being said, the creation has to exceed the destruction of jobs in order for economies to grow.

The alternative to newfound salaried work is capital work. In the major economies in the eighteenth and nineteenth centuries, income accruing to capital (via dividends, rents, profits, interest, royalties, etc.) as a portion of total national income was significant and steady over time. Income generated by capital then declined sharply in the twentieth century (from 1910 onwards). It grew again after 1970.[19] That capital work shrank in the first part of the twentieth century is not surprising. The nineteenth century was the era of liberal capitalism. The first half of the twentieth century was the age of socialism. Socialism despised income from capital while it eulogized income from wage work. The share of national income in major economies echoed this political disposition. After 1970, the portion of income from capital grew again. This in part reflected the decline of socialism, though it equally reflected the way in which socialism's agenda was replaced by regulation. The post-industrial era saw the proliferation of regulatory and process bureaucracies. This was the kind of salaried work that delivered few productivity gains. Accordingly, the income it generated over time stagnated. The tacit response of many individuals to this was to move away from salaried work.[20] This is reflected in the rise in the numbers and the income of sole traders and partnerships. In 1995, there were 16,423,000 sole proprietor tax returns lodged in the United States.[21] In 2012, the number was 23,426,000, an increase of 42 percent in 18 years;[22] meanwhile, over the same period, the population of the US increased by 22 percent only. Over the same interval, the total business receipts of sole traders grew from $807 billion to $1.3 billion, outpacing inflation by 7 percent.[23] There is every indication that, in the age of auto-industrialism, capital's share of income will rise further still.

table 3.1, accessed November 21, 2015, http://www2.deloitte.com/au/en/pages/economics/articles/digital-government-transformation.html.

16 Frey and Osborne, *Technology at Work*; Frey and Osborne, *The Future of Employment*; CEDA, *Australia's Future Workforce?*; Autor and Dorn, "Polarization of the US Labor Market"; Deloitte, *London Futures*; Jaimovich and Siu, "Job polarization and jobless recoveries."

17 Many of the white collar and pink collar job types being replaced are PAs, secretaries, library assistants, sales assistants, filing clerks, insurance clerks, and bookkeepers.

18 Deloitte, *London Futures*, 10, figure 4.

19 Piketty, "Capital in the Twenty-First Century," figure 3.5.

20 A myth is that they have been unhappy to do so. On the contrary, MBO Partners reported high levels of satisfaction among sole traders with their circumstances. MBO Partners, *2014 State of Independence in America* (Hendon, VA.: MBO Partners, 2014), accessed November 21, 2015, https://www.mbopartners.com/state-of-independence/2014-state-of-independence.

21 Data source: Internal Revenue Service (IRS) Sole Proprietorship Returns 1996 and 2012. See Therese Cruciano, "Sole Proprietorship Returns, 1996" *Internal Revenue Service* (*IRS.gov*), accessed December 10, 2015, https://www.irs.gov/pub/irs-soi/96solp.pdf; Dungan, "Sole Proprietorship Returns, 2012."

22 This represents an average of $55,000 a return.

23 The story is similar for partnerships. Between 2003 and 2012, the US population grew 8 percent. The number of partnerships reporting to the IRS rose 42 percent from 2,375,375 in 2003 to 3,388,561 in 2012; net income grew 258 percent from $301,398,218,000 in 2003 to $777,924,476,000 in 2012. Data source: Internal Revenue Service (IRS) Partnership Returns 2003 and 2012. See Tim

Design Capitalism

Repetitious work is being replaced by algorithms that control databases and robots. The scope of these algorithms continues to expand. There are arguments about the limits of machines, but it is fair to say that machines cannot currently perform "creative" tasks. An algorithm may be complex; a machine may have a capacity to learn. My household vacuum robot teaches itself the floor layout and can adapt to changes in that layout. It learns to avoid new obstacles. This is clever. But clever is not the same thing as "creative." What will the work of the future look like? It will likely become less routine. It will be work that cannot be defined by an algorithm. It will be less repetitive, predictable or regular in nature. This is work that has a creative, experimental, problem-solving, or ingenious component, or else involves a kind of manual dexterity that a machine algorithm cannot easily mimic or readily reduce to a set of well defined, repeating steps.

Modern capitalism is creative thanks to its double-coding. What I mean by this is that creative systems, modern capitalism included, interpolate opposites.[24] In other words, capitalism is like art. Cubism mimicked three-dimensional space on a two-dimensional canvas. René Magritte painted nighttime street scenes with a daytime sky. Machines are not ironic, ambiguous, incongruous, contradictory, or paradoxical…but human beings are. This is not a deficiency, but rather the great strength of being human. It is how human beings adapt to all manner of environments, places and circumstances. We adapt well because we interpolate opposites. We can see that what is down can also be up, as in an M. C. Escher drawing; or see what is not there, as in Alan Fletcher's design of the Victoria and Albert Museum logo.[25] This is not simply illusionistic; making sense of these kinds of things is central to human cognitive functioning. This cognitive double-coding – to see, hear or feel one thing as another – is what makes the human imagination possible.[26] When human beings imagine something, they conceive one thing in terms of another thing. This is the basis of metaphor, analogy, resemblance, similes, figurative thought, allegories, and all kinds of powerful images and symbols, be they visual, aural, textual, or tactile.

Modern capitalism – at its most subtle – is imaginative. This is what propels it forward. But, as noted, forward also means backwards. *Relativity*, Escher's 1953 lithograph print, prompts our eye to follow his stairs upwards. We ascend the stairs imaginatively only to find at a certain point we have been descending the stairs. The experience of this artwork is uncanny. Capitalist economies are also uncanny in roughly the same manner. This applies to work as much as to broader economic cycles. A lot of work is routine. That is to say, it does not have an imaginative component. In literature, we have many characters carrying out routine work who daydream. Their work does not require much imagination so the characters drift into their own reveries. At work, they imagine themselves at the beach. There is nothing special about this. Everybody has done it. That is also the nature of the imagination. Everyone has an imagination. Some individuals, though, are more imaginative than others. The same is true of societies.[27] Imaginative societies, those that are good at stimulating and harnessing the fruits of the imagination, do well economically. Organizational and technological invention drives high-growth economies. Part of invention is the invention of newfound kinds of work and the fostering of work that has ingenuity as a component.

If machines are replacing well-defined, step-by-step, routine work, what will employees of the future do? Some predict that "social" jobs, involving a high level of face-to-face interaction, will survive.[28] This expectation is exaggerated. Many interactions between people are repetitious in nature, as in the case of talking to a fast-food outlet cashier or a desk clerk in a hotel. Human beings do care deeply

Wheeler and Nina Shumofsky, "Partnership Returns, 2003" *Internal Revenue Service* (*IRS.gov*), accessed December 10, 2015, https://www.irs.gov/pub/irs-soi/03partnr.pdf; Ron DeCarlo and Nina Shumofsky, "Partnership Returns, 2012" *Internal Revenue Service* (*IRS.gov*), accessed December 10, 2015, https://www.irs.gov/pub/irs-soi/soi-a-pa-id1504.pdf.

24 Peter Murphy, "Seeing Double: The Deep Core of the Imagination" in *TransVisuality—Dimensioning the Visual in a Visual Culture*, ed. Tore Kristensen, Anders Michelsen, and Frauke Wiegand (Liverpool: Liverpool University Press, 2013).

25 Alan Fletcher (1931–2006) was arguably the greatest British graphic designer of his generation.

26 Peter Murphy, Michael Peters and Simon Marginson, *Imagination: Three Models of Imagination in the Age of the Knowledge Economy* (New York: Peter Lang, 2010).

27 Murphy, *The Collective Imagination*.

28 See, e.g., Deloitte, *London Futures*.

about personal connections, but not this kind. They care about connections that are surprising, not in the sense of "shocking, astounding or startling", but in the sense that they are not rote. Meaning at its deepest is a function of the imagination. Repetitious behavior can be meaningful, but only to a point. People derive only a partial sense of meaning from ritual and the predictable rounds of everyday life: that the world is not chaotic. But guarantees against a messy, unruly and confused world do not provide a depth of meaning. They do not tap into profound layers of meaning. The imagination, by contrast, does this very thing. Using it is what provides social actors with a durable sense of satisfaction or happiness. Exercising the imagination puts them in a good place. It consummates, fulfills, and gratifies. Naturally, this sense of well-being is a personal matter. However, it also has an economic function. Economies succeed when goods or services generate demand, and human beings most want goods and services that somehow foster a sense of consummation, fulfillment, and gratification.

This happens most often when a good or service has an imaginative component. For example, we get service in a restaurant. It is often the case that restaurant service is most memorable when there is witty banter between the waitress and the customer. Wit is a function of the imagination.[29] We say one thing and mean another thing. As long as we are in a mood for humor, that is enlivening for everyone. In contrast, machines are not funny. They are proficient, useful, time-saving, and labor-saving. But they are not humorous. This is not an argument for a stand-up comedy economy. Rather it is an illustration of what the imagination imparts to goods and services. Of course functionality, efficiency and ease of use contribute to our enjoyment and satisfaction. But in addition, the most attractive goods and services stimulate a lasting memory in people by tapping into our cognitive capacity to perceive and experience double-coding, be it linguistic, formal, visual, theoretical, or otherwise. The ability to recognize two-in-one is the substratum of the human imagination, a thread running between art and design and (everyday) life. It underscores a more general proposition: the work of the future will have to be more imaginative, or else it will be turned over to machines.

So what constitutes the imaginative dimension of work? One way of answering this is to approach the question via a historical metaphor. Four decades ago a major shift occurred in advanced economies. These economies had large manufacturing sectors that were in decline. Jobs were either automated or exported abroad to low-wage countries. The first industrial robots were installed in a Trenton, New Jersey General Motors plant in 1961. This was a sign of things to come. By the 1970s, factories began move offshore. Today robotic systems are now so cheap and functional that factories are relocating to the countries they exited from during the post-industrial era. As the auto-industrial age begins, people-less factories are springing up along with people-less warehouses. These will be eventually integrated with driver-less transport systems. None of this represents an increase in jobs; quite the contrary. But that is not the full story, for computer-controlled factories still need to manufacture products. Those products have to generate demand and satisfaction. A good price, an efficient delivery system, and a durable artifact are all part of what generates consumer satisfaction; but before all that, there is the imaginative aspect of the product that draws the user to it.

Goods and services that appeal to the imagination have a way of generating a deep level of satisfaction. This imaginative element is not a simple matter to define. But often a key part of the imaginative component of a good or a service lies in its design. Design is a loose term for the form, shape, arrangement, pattern, or profile of a good or service. Design is usually responsible for a product's durability. Fitness, form, efficiency, and pattern are also closely related. And design is also a surface quality: for most of us, it is satisfying to look at, listen to, touch or taste its shape

29 Murphy, *The Collective Imagination*, 35–52.

and pattern. The satisfaction is sensual, cerebral, and metaphysical. With the passage of time, of the three key elements that might describe a good or service (utility, ease of use, and beauty), the element of beauty increases in importance.

If we could plot an arc that spans across the last two hundred years of industrial capitalism, we would see that the initial interest in industrial-scale goods and services was weighted toward utility. *Does it work?* With time the importance of ease of use or consumption grew. *Is its distribution, handling, and performance efficient and pleasant?* As more time passed, the importance of aesthetics increased. *Does it look, feel, or sound good? Does it appeal to my imagination?* Utility, ease, and aesthetics are three dimensions of design. They are co-present in design, though weighted differently according to circumstance. The shift of consumer bias toward the factor of aesthetic look-and-feel in goods or services was signaled by the success of Steve Jobs' Apple Corp in the 1980s.[30] Jobs believed that it was the job of his company "to teach people aesthetics."[31] By no means was the Apple story typical of its time. Even today Jobs' meticulous insistence on getting the look of the interior of his computers "right" is atypical. But Apple's approach did indicate an increasing market for everyday aesthetics – itself a function of a larger historical trend. From 1810 to 1897, the usage of the word "design" declined.[32] After 1897, it increased – and notably so after 1936 and again after 1967. The steep rise in the use of the term after 1967 reflects the spread of everyday aesthetics in housing, urbanism, and retail.[33] Various models for everyday aesthetics include the "arts-and-crafts" movement (1880–1910), the "city beautiful" movement (1890–1910), the "garden city" movement (1900–1960), Art Deco (1920–1950), the German Bauhaus (1920–1940), and Fluxus (1957–1978). Little-by-little, aesthetic sensibility has percolated into everyday life.

At first glance, the aesthetics of design and the practical nature of economics might seem far removed from each other. Yet take the case of Chandigarh, the Indian city designed by the modernist architect Le Corbusier. The city has the highest per capita income in India. This, arguably, is no accident. Rather it is a result of the way in which aesthetics functions as a subtle mode of production. The contemporary citizens of Chandigarh (India's "city beautiful") are testament to this. They have benefited from the paradoxical entwining of aesthetics and economics. Chandigarh enjoys a contemporary growth rate of 8 percent and a per capita income that is three times India's national average. Its citizens profit from a high rate of literacy, there are attractive gardens, and the technology industry is booming. The city that grew out of Le Corbusier's 1951 master plan has proved to be a long-term crucible for economic well-being.[34]

In a similar manner, there is no better expression of either aesthetic modernism or the information economy than Jonathan Ive's design of the iPhone, a beautiful steel-and-glass handheld tablet.[35] This kind of imaginative design of everyday objects has extended itself in many directions. The Swedish manufacturer Husqvarna produces a popular line of robot motor mowers. As Husqvarna says about its product: it works, it won't disturb anyone, and it operates anytime, even in the dark. What is notable however is not just the fact of automation, but also the sleek futuristic design of these units, and additionally what customers do by way of aesthetic add-ons. Owners embellish their mowers with graphic design motifs and build kennel-like garages for them. The robot making its way home to its docking station has a pleasingly anthropomorphic quality. The product is functional (it works), pleasurable when used (it doesn't disturb the neighbors), and it looks beautiful (futuristic, elegant).

The manufacture of goods themselves is increasingly automated. Labor costs in the 1970s were a major consideration in factory location. That has declined as factory automation has expanded. Husqvarna has production facilities in Europe,

30 Walter Isaacson, *Steve Jobs* (London: Little, Brown and Company, 2014).

31 Isaacson, *Steve Jobs*, 265.

32 Google N-Gram analysis of the word "design," accessed November 21, 2015, https://books.google.com/ngrams/graph?content=design&year_start=1800&year_end=2015&corpus=15&smoothing=3&share=&direct_url=t1%3B,design%3B,c0.

33 Peter Murphy, "The Aesthetic Spirit of Modern Capitalism," in *Aesthetic Capitalism*, ed. Peter Murphy and Eduardo de la Fuente (Leiden: Brill Publishers, 2014).

34 Among the top ten wealthiest cities per capita in India, a number of them including Pune, Panaji, Chennai, and Delhi are notable for their history of architectural design ranging from Dravidian, Hindu, Islamic and Goan-Portuguese to Gothic Revival, Indo-Saracenic, Garden City, Art Deco, and Modernist.

35 Isaacson, *Steve Jobs*, 465–74.

the US, Latin America and Asia. But the once pressing need for high-wage countries to export factories now is being over-taken and outdated by the declining price of the robots used in factory automation. As the unit price of automated machines declines, factory location close to consumer markets becomes more of a consideration than the cost of labor. But that then leaves advanced economies with a puzzle: what does labor do in the future? This is not just a question for long-standing leading economies. China is increasingly deploying robots in its factories.[36] Its population is rapidly ageing, and its young people are less and less interested in doing factory work.

Durable work with a long-term future is hence increasingly a function of "design." This proposition ought not to be taken too literally. It does not mean that national labor forces are suddenly going to be swamped by "designers" in the narrow occupational sense of that word. The most in-demand occupations in the emergent auto-industrial era are transdisciplinary: they merge arts, science, design, technology, and business disciplines. Transdisciplinary abilities are essential for future businesses, like running a 3D-printing start-up company, which would require knowledge of digital fabrication tools and methods, computer programming, and visual design. 3D printing's small-run, prototyping style of desktop fabrication is an auto-industrial technology that has a strong do-it-yourself component and a model of value creation that revolves around design fused with technology and mathematics.[37] The ability to design and print objects large-and-small in almost any material, embodying complex geometries, has enormous potential for bespoke structures of all kinds including houses and multi-storey buildings.

Additive manufacturing represents the power of design in a broad generic sense.[38] Yet design is also a specific occupation. Design as an occupational category is growing in advanced economies. It is one of a minority of mid-tier, middle-income job categories in the United States that has kept pace with the rate of population growth. In the United States in the year 2000, there were 339,000 designers; in 2014, there were 445,000, which represents a 30 percent increase over 15 years, compared with America's 12 percent population growth over the same period.[39] Design jobs – in the narrow occupational sense – are liable to continue to grow steadily, whereas jobs like that of a health assistant, often cited as a growth occupation of the future, are susceptible to automation. The argument that the health assistant is a 'high-touch' social occupation, and as such immune from automation, does not stand up to close scrutiny. Repetitive people jobs are just as liable to be automated as repetitive paperwork jobs. It is work that is not repetitive that will escape replacement by machines.

Design is resistant to automation because, at its core, it involves pattern thinking and making. Durable future occupations will be those that produce, interpret and apply patterns, shapes, and forms rather than if-then rules. Pattern-work involves a broad spectrum of abilities, from high-concept thinking through to everyday problem solving. It is rooted in the imagination. It relies on the double-coding of the imagination. Alan Fletcher's 1993 John Cage poster depicting a man shouting "*I have nothing to say and I am saying it*" captures something of the *double entendre* of the imagination from which wit, ideas, and the general capacity of human beings to productively manage ambiguity arises. Patterns, shapes and forms all interpolate opposites. They are built around contrasts: solid-and-void, black-and-white, presence-and-absence, abundance-and-scarcity, above-and-below, agreement-and-disagreement, entrance-and-exit, internal-and-external, frequent-and-rare, hard-and-soft, and so on. A pattern or shape is created by the coalescence of opposites. It is the subtle interaction of solid and void or internal and external space that forms the pattern. The merging, union and combination of opposites is

36 Caixiong Zheng, "Robots go it alone at factory with no assembly workers," *China Daily US*, May 5, 2015, accessed November 21, 2015, http://usa.chinadaily.com.cn/china/2015-05/05/content_20620256.htm.

37 Peter Murphy, "The Desktop Factory of the New Industrial Revolution," *Quadrant* 58, no. 10 (October 2014): 32–35.

38 It also symbolizes an economy focused on design-driven productive capital rather than on finance capital—that is, on making not banking. Finance capital tacitly dominated many of the major economies in the latter declining half of the post-industrial era. The opportunities for industrious investments shrank in this period while bank savings grew. This encouraged speculation instead of production.

39 Source: Bureau of Labor Statistics, "May 2014 National Occupational Employment and Wage Estimates United States," last modified March 25, 2015, accessed December 10, 2015, http://www.bls.gov/oes/current/oes_nat.htm. Designers are Standard Occupational Code (SOC) 271020. In contrast, the number of artists (both fine artists and multimedia artists), remained static over the period, declining in real terms relative to population by around 15 percent.

what the human imagination readily does. This cognitive capacity varies from individual to individual. At the high end of human experience, the fusion of opposites can be intense and exceptional. This is when the human mind creates patterns. Some of these, the exceptional ones, are uncanny. They tap deeply into the human imagination. They appear to us like a Cézanne landscape. This landscape painting presents a stony outcrop. We can see the clear flinty outline of rocks. At the same time the rocks seem to be liquid. They pour down from the escarpment. The perceptible *hard rock=liquid flow* motif epitomizes the human imagination. All imagination, even the most trivial everyday problem-solving examples, seeks the epitome. It does not reach this state routinely, but in each case there is a faint trace of the topological nature of the imagination.[40]

Topological cognition, which seeks some form of uncanny connection, is different from human reason. Human reason is the model for algorithmic machine intelligence. The creative aspect of this is that artificial intelligence (AI) designers began conceptually by 'drawing' an analogy between the human capacity for if-then reasoning and a machine's potential for programmed step-by-step intelligence. There is a likeness between the two. Yet there is also an unlikeness between imagination and reason. Accordingly, the conceptual design of the reasoning machine relied on the kind of topological imagination that is denied to the machine. That same topological imagination is what allows human beings to conceive interesting things. In this lies the core of a modern advanced economy. It is necessary that activities and tools are efficient and easy to use, utilize or perform. But advanced economies have to achieve more than that. They must also create interest-value. In doing so, they create demand.[41] Objects and activities, services and goods are interesting to the extent that they share in, even just a tiny amount, the double-coding that takes place in the imagination. Not everything in the world is interesting. Much of what we do and experience in life is not interesting. But human satisfaction and gratification, central to modern markets and economies, rely on us being able to produce in varying degrees what is appealing and stimulating.

As the auto-industrial age spreads its wings, the repetitious and rule-governed aspects of production and distribution are being automated. The rapidly approaching auto-industrial era is one that is characterized by self-service computerization, digital platforms, artificial intelligence, robotics, people-less factories, and a generally high degree of technological automation. Job markets as we know them are being redefined by this change. A large portion of existing non-dexterous manual and rule-based office work will be automated. Less clear is what will replace the jobs that have been replaced; excepting that future types of work will substitute patterns for rules. Patterns repeat; but not like rules. Where rules guide humans and machines through repetitive if-then steps, patterns repeat an act of creation. This is the act of equating void and solid, up and down, empty and full, black and white. Patterns, designs, shapes and forms excite the human imagination because they are subtle reminders of the primal act of creation. They remind each of us what the imagination is capable of. That is satisfying. From such satisfactions arise the demand for goods and services that embody ingenious patterns. From this virtuous cycle emerges the economic dynamism of the modern capitalist economy.

40 On the topological structure of the imagination, see Peter Murphy, "Topeme: Truth. Topology. Cartography. Ana|logy. (The Hydra Project. Morphology, Topology, and Artifice: Cartographical Aesthetics and an Architecture of the Event)," (presentation at Architectural Research Seminar at the Royal Danish Academy of Fine Arts, Schools of Architecture, Design and Conservation, May 22–23, 2014), available at http://old.karch.dk/hydra/Materiale/Myrphyabstract.

41 This follows Jean-Baptiste Say's Law: *supply creates demand*. See Peter Murphy, "The Aesthetic Spirit of Modern Capitalism."