

Competition or Liberation? Implications of Labour Automation in the Context of Cognitive Capitalism

by

Russell Burgess

A thesis submitted to the Faculty of Graduate and Postdoctoral
Affairs in partial fulfillment of the requirements for the degree of

Master of Arts

in

Political Economy

Carleton University
Ottawa, Ontario

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Abstract

Technology in the first half of 21st century are developing new abilities to perform autonomously and compete with humans directly in more and more tasks, opening up the future possibility of increasing labour substitution. Using the theory of Cognitive Capitalism to examine advanced economies as the most recent form of capitalism shows that in the modern economy work is increasingly central to the lives of individuals due to new cognitive labour which requires more worker engagement than industrial labour. This requirement has strengthened the direct coercive mechanisms of the increasingly precarious wage relationship and weakened alternate income sources. This dissertation argues that automation in this context could be harmful to individuals required to depend on work to survive and evaluates three policy options against the goal of freeing individuals from this institutional constraint to work so that they can continue to fully and freely participate in society if widespread automation occurs.

Acknowledgements

This work would not have been possible without the help of my supervisor Marc-André Gagnon, who helped guide the theoretical foundation of the work and allowed me to write a serious academic project with robots and *Star Trek*.

The Institute of Political Economy's coordinator Donna Coghill was also instrumental in keeping the timeline straight for a big project like this.

And finally a thanks to Vicki and all the friends, family, and fellow students who remind me there is life outside of work, so we can keep each other sane around deadlines.

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Introduction

On March 8, 1968, an episode of *Star Trek* aired titled "The Ultimate Computer." In this episode, the USS *Enterprise* is chosen as the testbed for a revolutionary new computer technology known as the M-5 Multitronic Unit, developed by Dr. Richard Daystrom. The *Enterprise* had always been equipped with computers, but the M-5 networked these existing discrete computers together into a single system newly capable of simulated thinking and an ability to reason. Almost immediately there is tension. Captain James Kirk is opposed to the computer as detrimental to human life, saying "There are certain things men must do to remain men."¹ Daystrom defends the automation of the *Enterprise* as a benefit to human life, saying "Men can live and go on to achieve greater things than fact-finding and dying for galactic space."² Both characters want the best for humanity, but for each automation plays a very different role, either stealing their purpose in life or liberating them from it. Though a fictional treatment, this argument is one example of a real-world debate that has been approached many times through history.

With the discussion of automation, technology, and revolution, there is often a conflict between the hope and fear of its potential. John Maynard Keynes wrote in a 1930 essay that in the economy "a hundred years hence" the technical advances which drove improvements in the quality of life up to that point would continue, and that the economy may be able to undertake the operations of agriculture, mining, and

¹ "The Ultimate Computer" *Star Trek*. Gene Roddenberry. Perf. William Shatner, Leonard Nimoy, DeForrest Kelley. NBC. WBCN, Boston. 8 March 1968.

² Ibid.

manufacture "with a quarter of the human effort to which we have been accustomed."³ Keynes states that there will be technological unemployment, the "means of economizing the use of labour outrunning the pace at which we can find new uses for labour" but that it would be a temporary phase of "maladjustment" before a period of increased leisure, due to the high bounty and abundance "that science and productivity will have won."⁴ In ancient times, Aristotle writes that if lyres could play and looms could weave "without a hand to guide them," that "chief workmen would not want servants, nor masters slaves."⁵ For the most part these views are desirable. Reducing slavery is a positive development, and a life of leisure earned through abundance is a good outcome.

The fear of automation, on the other hand, fears the loss of jobs that automation could entail. Between 1811 and 1817, a group of British textile workers known as the Luddites vandalized and destroyed mechanized looms, motivated by the fear of losing their livelihood.⁶ Ultimately the Luddites' unemployment was localized and their fears unrealized, and their movement instead became the basis for the economic principle known as the Luddite Fallacy. This principle asserts that new technology results in the creation of new and better jobs, resulting in equal or greater employment than before, and that the Luddites were wrong to oppose it.⁷ But the Luddites are not the only group to fear automation. Karl Marx writes of a form of automation in his unfinished

³ John Maynard Keynes, "Economic Possibilities for Our Grandchildren," in *Essays in Persuasion* (London: Rupert Hart-Davis, 1931), 364

⁴ *Ibid.*, 364

⁵ Jaron Lanier, *Who Owns The Future?* (New York: Simon & Schuster, 2013), 22

⁶ Erik Brynjolfsson & Andrew McAfee, *Second Machine Age* (New York: W.W. Norton, 2014), 173

⁷ *Ibid.*, 175

Grundrisse, where the worker engages in a struggle with machinery, and "only in the imagination of economists does [machinery] leap to the aid of the individual worker."⁸ In 1949, Norbert Wiener, a mathematician at MIT, predicted the future importance of computers to automation by saying anything that can be done in a clear and intelligible way can be done by computer, and that this would create "an industrial revolution of unmitigated cruelty."⁹ And in 1964, a group of prominent journalists, academics, and scientists formed the Ad Hoc Committee of the Triple Revolution, where the third aspect of the Triple Revolution was "automation and cybernation," and in a letter to President Lyndon Johnson, the Committee warned that if the report was not acted upon, the "nation will be thrown into unprecedented economic and social disaster."¹⁰ Dire predictions of economic disruption that go unfulfilled only seem to strengthen the case of the Luddite Fallacy, and yet the fear remains.

Something about the relationship between work, technology, and society leads to two views of the same outcome, with differences in who controls the outcomes and whether every group in society benefits. How can the idea of technology replacing humans in jobs be both a positive development and something to be feared? Ignoring the constraints of an episode in a continuing television series, "The Ultimate Computer" has lost philosophical promise in that the question is never conclusively answered. However, the M-5 describes itself and its goal as "the ultimate achievement in computer

⁸ Karl Marx, *The Grundrisse* (New York: Vintage Books, 1973), Notebook VII, 702

⁹ Martin Ford, *Rise of the Robots* (New York: Basic Books, 2015), 32

¹⁰ *Ibid.*, 31

evolution, it will replace man so that man will achieve,"¹¹ a statement much more aligned with Keynes' prediction than the fears of the Luddites.

Recently there are growing challenges to the Luddite Fallacy, with more and more new technologies appearing that are capable of replacing people entirely in some occupations. One study in 2013 by Michael Frey & Carl Osborne suggests that 47% of current occupations are at risk being automated in the next 20 years.¹² Computers are the main culprit, a general purpose technology that can now be found in almost any industry, in almost every home and increasingly carried regularly by many people on their person. New tasks that computerization is becoming capable of include decision-making, diagnostic tasks, and pattern recognition. These abilities are already having an impact on non-manufacturing employment in many different service sectors, for instance in legal and financial services.¹³ Stock markets are now mostly run by automatic trading algorithms and "matching engines,"¹⁴ and many legal tasks performed by paralegals, contract workers, and patent lawyers are being supplemented by algorithms as data is digitized.¹⁵ Online translation, self-driving cars, medical diagnostics and online courses are also being developed, indicating potential advances in retail, education, and health sectors. Computing technology has accomplished some of these tasks through a technical advance known as Deep Learning, behaving less like

¹¹ "The Ultimate Computer" *Star Trek*.

¹² Carl Frey & Osborne, Michael, (September 17, 2013), "The Future of Employment: How Susceptible Are Jobs to Computerization?" Working paper presented at the Machine and Employment workshop, Oxford University Engineering Sciences Department, JEL: E24, J24, J31, J62, O33, 1

¹³ *Ibid.*, 17

¹⁴ Michael Lewis, *Flash Boys* (New York: W.W. Norton, 2014), 3, 35

¹⁵ Frey & Osborne, *The Future of Work*, 17

fixed capital and more like human capital as it improves by self-producing new algorithms from the observation of data through multiple layers of artificial neural networks.¹⁶

Still, computers have been around since Norbert Wiener wrote of their automating potential in 1949, which could indicate that while a necessary condition of automation, the presence of technology alone is not sufficient to explain how it could be applied. Whether the future allows a life of freedom and leisure as Keynes predicts or cuts off some people from their livelihood as the Luddites and Ad-Hoc Committee feared may also depend on the social environment in which computers develop. Both may occur to different groups in current society, which could be part of the growing income divide in advanced economies. In the present day, the dominant economic form is that of capitalism, which means that if automation technology lives up to its promise, an understanding of capitalism as the context of technological development and deployment could be as important as understanding the technology itself in examining the possible outcomes.

In order to determine how these new technological developments and capabilities could affect people, we must first understand the nature of the current economic environment, and how economic rewards are distributed. As mentioned, the dominant economic logic of the globalized economy is capitalism, where the leading goal of its participants is earning profit. Capitalism is not a monolithic or static system, however, and there have been different variations of capitalism, from Adam Smith's description of local economies to the industrial revolution, the rise and fall of Bretton Woods and

¹⁶ Nicole Rusk, "Deep Learning," *Nature Methods*, 13(1), January 2016, 35

Fordism, and the current form variously described as the "new economy" or "information age." This is important to note because these forms approach profitability in different ways. Industrial capitalism, which focused on manufacturing and direct labour, accumulated profits and increased profitability by increasing production of material goods through control over productivity and scale. This is no longer the case in the new form capitalism has taken.

To study this most recent form of capitalism and how automation could work if introduced this paper will use a theoretical framework called Cognitive Capitalism, a theory that explores the relation between existing capitalist structures such as profit-making and employment and the increasing importance of knowledge as a leading factor of economic growth, even when these two sides are contradictory. Yann Moulier Boutang calls Cognitive Capitalism a coherent system and a dynamic process that is strengthened rather than weakened by these internal contradictions.¹⁷ The goal of the participants of capitalism in earning profits remains, but the source of those profits is no longer from manufacturing products using a labour force. In Cognitive Capitalism, profit is primarily derived from the intellectual commons, or what Marx terms the General Intellect, which is the accumulated sum of social and scientific knowledge in a society.¹⁸ Organizations with access to the most developed scientific knowledge are able to drive new technology and increase productivity to become more profitable. The challenge this poses is that the main concepts of capitalism evolved around the manufacturing and sale of rival material goods, and developed to deal with discrete,

¹⁷ Yann Moulier Boutang, *Cognitive Capitalism* (Cambridge, U.K.: Polity Press, 2011), 47

¹⁸ Marx, *Grundrisse*, Notebook VII, 704-705

individual sources of value and costs internal to the firm, like fixed capital, physical materials, or individual workers. The nature of the General Intellect existing at an external, societal level freely available to everyone means that fundamental capitalist concepts like profit, value, and wages do not apply to the knowledge production process in the way they did to manufacturing. Labour still exists as a process internal to the firm, but the source of wealth is not the labour itself but "the agencies set in motion during labour time," where the profit generation of internal labour depends on the externalities of the General Intellect.¹⁹ As immaterial knowledge goods are non-rival, pricing based on scarcity is no longer possible, and without discrete units of production measured by time, assessing compensation also becomes difficult. This is a significant challenge to capitalism, because the measurement of value and price is what makes it possible to distribute the surplus value.²⁰

Cognitive Capitalism is the study of adaptation and new forms of control that "allows capitalism to thrive in spite of the emergence of a General Intellect as Marx predicted," where control of the means of production is replaced with "the means to control the community's cognitive capacities."²¹ One such means is adopting rentier systems to valorize goods, which assigns value to immaterial goods by creating artificial scarcity through mechanisms such as intellectual property. As the source of economic growth exists outside the firm, command over the internal production process becomes

¹⁹ Marx, *Grundrisse*, Notebook VII, 704

²⁰ Andrea Fumagalli & Cristina Morini, "Life Put To Work: Towards A Life Theory of Value," *Ephemera* 10(3/4), accessed January 31, 2016, <http://www.ephemerajournal.org/sites/default/files/10-3morinifumagalli.pdf>, 238

²¹ Marc-André Gagnon, "Capital, Power and Knowledge According to Thorstein Veblen: Reinterpreting the Knowledge-Based Economy," *Journal of Economic Issues*, 41(2), 598

a struggle of command over the markets by asserting ownership rights over knowledge goods, and profit comes from selling access to goods and services as rent rather than selling goods or services themselves, especially since the marginal production costs of many of these goods are "practically nil."²² The contradictions that Moulier Boutang refers to arise between these adaptations of capitalism, and other parts of capitalism that persist in spite of these changes, such as pricing mechanisms dependent on the scarcity of goods, individual employment and time-based remuneration of work.

Understanding the nature of work in Cognitive Capitalism is particularly important because the primary means of earning income in a capitalist economy is employment. The predictions for automation, both those that highlight the benefits and those that highlight the fears, focus on the relationship between automation and work. The benefits, as noted by Keynes in his essay, could involve the reduction of necessary work, freeing people to do what fulfills them, rather than what sustains them. The fear of the Luddites and the Ad-Hoc Committee of the Triple Revolution was that without work, there would be no livelihood. Both optimism and pessimism in this case share the conception of work as access to the means of survival, which in the capitalist context is monetary income. For the majority, without work there is no income, and pay is needed for full participation in society.

Cognitive Capitalism problematizes this definition of work under the wage relationship. Moulier Boutang dates the creation of the wage relationship to the time of the enclosure movement, which culminated in England with deliberate state action in

²² Carlo Vercellone, "The Becoming Rent of Profit," *Knowledge Cultures*, 1(2) 2013, 272-273

the Parliamentary Enclosures.²³ The wage relationship's persistence under Cognitive Capitalism is a similar deliberate effort. Maintaining a facsimile of industrial work arrangements is counter-productive to an economy with declining marginal costs and the need to capture the positive externalities of society's scientific and social progress, but as André Gorz writes, "for capital, the domination of labour power has always been the condition of its utilization. It is better, from its standpoint, to give up on certain potential externalities than to give up dominating labour."²⁴ Since the measurements that go into calculating remuneration for work no longer apply, new strategies are required to maintain the dominance of labour, such as the rise of project-based pay and indeterminate contracts. This maintains the exchange of work for pay and keeps the employee compliant to whatever terms the contract specifies, while sidestepping the problem of labour-time calculations.²⁵

The disconnect between the nature of cognitive work and the structure of the wage system means that the economic outcomes feared by the Ad-Hoc Committee and the Luddites are already happening without automation. Where automation replaces humans in the jobs and the amount of necessary work, in cognitive capitalism the value of some tasks has been diminished by the economic transition, leading to precarious work that does not provide stable income, and a stagnation in the real wages that are paid. At the same time, welfare measures to support individuals with insufficient income are evolving into a workfare system that is targeted and low-paying, making it

²³ Moulier Boutang, *Cognitive Capitalism*, 102

²⁴ André Gorz, *The Immaterial*, Trans. Chris Turner, (London: Seagull Books, 2010), 110

²⁵ Moulier Boutang, *Cognitive Capitalism*, 143

unreliable.²⁶ As mentioned before, this leads to a division between the small minority well-compensated for their talents, and the majority who are not.²⁷ Automation in the capitalist environment could worsen these trends, reduce access to income, and become a visible force driving wage stagnation and unemployment.

This dissertation will analyze the new developments of automation technology, in the context of the advanced market economies examined in Cognitive Capitalism. In doing so, the goal is to answer or address one main question: how can advanced market economies ensure that automation fulfills its theoretical goal of liberating people from necessary work rather than becoming another coercive force ensuring the compliance of employees to capitalist interests? To answer this question the following topics must be examined: what kind of technological advances are enabling automation, how are economic rewards distributed in the current form of capitalism, and how might the nature of modern capitalism determine what kind of impact new automation technology could have on people?

As Marx writes, capitalism involves two contradictory forces "in that it presses to reduce labour time to a minimum, while it posits labour time, on the other side, as the sole measure and source of wealth."²⁸ Technological development is one form this pressure takes in reducing labour time to a minimum, while the wage relationship keeps individual labour as the sole measure and source of wealth. As long as this contradiction persists, the threat of technological unemployment could remain. But if this tension is

²⁶ Carlo Vercellone, "From The Mass Worker to Cognitive Labour: Historical and Theoretical Consideration," Marcel van der Linden & Karl Heinz Roth ed. *Beyond Marx* (2013) 184-185

²⁷ Ibid., 186-187

²⁸ Marx, *Grundrisse*, Notebook VII, 706

what drives the fear of automation, then solutions such as those advocated by Cognitive Capitalism theorists that reconceptualize income distribution may also work to alleviate it. In combination with new economic institutions and new ways about conceptualizing work, income, and the economy, rather than something to be feared automation could be a positive force in moving away from what Gorz calls the "work-based society."²⁹

There are several existing methods in theory and in practice advanced with the goal protecting people from the loss of income that unemployment brings. Anthony Atkinson suggests a program of guaranteed employment, treating employment as a right that should be freely accessible to all citizens.³⁰ Another approach is one used by Denmark known as flexicurity, which combines a robust unemployment benefits system with comprehensive education programs designed to help citizens upgrade skills and find work.³¹ A third policy, advanced in theories across the political spectrum including Cognitive Capitalism, is basic income, where every citizen in an economy gets a guaranteed annual minimum income payment from the state independent of their employment status. This dissertation aims to theoretically evaluate some of the benefits and complications of each of these three policy suggestions in addressing unemployment driven by technology and in the cultural and institutional context of modern capitalism as understood by Cognitive Capitalism.

The first chapter will explore the background of automation technology, and explain what new developments are enabling the expansion of occupations susceptible

²⁹ André Gorz, *Reclaiming Work: Beyond The Wage-Based Society* (Cambridge, U.K.: Polity Press, 1999), 1

³⁰ Gorz, *Reclaiming Work*, 64

³¹ Sylvain Lefèvre et. al., *La Pauvreté* (Montreal: Champ Libre, Les Presses de l'Université de Montréal, 2011), 39

to automation and how they work. This will include a more technical focus, looking at why technological progress is different now in comparison to earlier progress, and what sets computers apart from earlier technologies that automated certain labour processes.

The second chapter will be an introduction of Cognitive Capitalism theory to analyze the current economy, primarily in terms of the nature of work and the wage-relationship as income distribution. This will apply the theory to some of the major trends in the current economy, and will compare and contrast the structures of industrial capitalism and cognitive capitalism, to see which structures and features are new and which continue from industrial capitalism.

The third chapter will build on the second chapter and analyze the predictions and theories of automation, applying these theories and new automation technology to Cognitive Capitalism, and exploring how automation could affect people in the cognitive capitalist economy. The aim of the chapter will be to highlight the central tension of technology in capitalism as the role of culture and the wage relationship as forces driving people towards employment while the deployment of automation is intended to reduce the amount of employment available. This central tension will be examined as the cause of the hope and fear dichotomy of automation theories.

The fourth chapter will introduce possible policies to address the tension between the drive towards employment and automation outlined in the third chapter. This chapter will discuss the advantages and disadvantages of several possible policy responses and how they relate to the goal of supplementing people's income in conditions of low employment and precarious work that could result from automation. This list consists of guaranteed employment, flexicurity, and some form of Basic

Primary Income (BPI). The focus of these policies will be on how well their approach succeed given a potential future context of declining overall demand for employment.

Whether Keynes, Marx, or other authors considering automation, the appearance of autonomous technology challenges the basis of modern society in work and income. Unlike the automation of Keynes and Marx, however, this new wave of cognitive automation developing new abilities to adapt, learn, and interact means that the impact of future automation could extend beyond what Marx or Cognitive Capitalism anticipate. This new technology may only be in its infancy, but its nature and potential means that understanding it could be critical to understanding how society could further develop.

1. The Changing Technology And Economy of the 21st Century

Large shifts in the economy can come from the introduction of what economists call "general-purpose technologies," defined by Gavin Wright as new ideas or techniques that have an effect of growing productivity in multiple sectors of the economy.³² The computer is only the latest in a series of general-purpose technologies, following steam engines, internal combustion engines, and electricity. One area in which computers differ from previous technologies is the speed of their improvement and adoption. Another element which sets the technology of the information and knowledge economy apart from earlier technologies in history is its division into two components. Many technological inventions come from innovations in materials, engineering, or harnessing new forms of energy. Computers share this in the development of their hardware, but add a new component: the software. Martin Ford writes that:

Information technology, to a degree unprecedented in the history of technological progress, encapsulates intelligence. Computers are machines that can - in a very limited and specialized sense - *think*.³³

Computers exist not only in the physical world, but in a separate immaterial sense as well, and how effective they are depends not only on their speed and power, but on how effectively physical concepts and information can be digitized into this immaterial

³² Brynjolfsson & McAfee, *Second Machine Age*, 76

³³ Ford, *Rise of the Robots*, 73

level for use by the software. Developments in both hardware and software are responsible for the current abilities of automation technology, but it is the software layer which differentiates current automation from previous mechanization.

The Rapid Pace of Hardware Evolution

Hardware forms the important foundation of modern automation technology, for software's capabilities depend on the speed, storage, and perception of computer hardware to enable them. There are many statistics used to calculate and track these capabilities, such as bits and bytes for memory capacity, hertz as a measure of frequency used for measuring processor speed, and flops for overall computing power. The first two are commonly seen when looking in stores or websites for ordinary personal computing devices, and in 2016 are usually presented in larger units such as gigabytes or gigahertz, and for some larger hard drives, terabytes. A flop, or floating point operation, is a measure used to benchmark computer speed. This consists of determining how many times per second a computing device can run a mathematical equation with a variable decimal point, such as 24.45×324.6848 .³⁴ By following these measurements, the speed of progress of hardware capability can be tracked.

For background, consider another general-purpose technology, the steam engine, described in an essay by M.A. Alderson as "the noblest machine ever invented by man - the pride of the machinist, the admiration of the philosopher."³⁵ James Watt is most commonly associated with the steam engine, but the first commercially successful

³⁴ Bryjolfsson & McAfee, *Second Machine Age*, 49

³⁵ Richard L. Hills, *Power From Steam* (U.K.: Cambridge University Press, 1989), 12

engine was invented by Thomas Newcomen in 1712. Although Watt's re-engineering of the steam engine allowed its widespread adoption, its introduction in 1776 was over half a century after Newcomen's design in 1712. Newcomen's design was itself an improvement on the first commercial attempt at steam power, an unsuccessful but functional steam engine design by Thomas Savery in 1698, and theoretical designs for steam engines had been circulating since a paragraph by the Marquis of Worcester in 1660.³⁶ Thus the period from the first attempted model, to the first practical engine, to the technological adoption across industries spans seventy-eight years, and including the earlier decades of experimentation and "intellectual pursuit," the time frame further extends to 116 years.³⁷ Still, this revolution was the fastest change in technology the history of the world had seen up to that point.³⁸ Today's technology operates on a far different timescale.

The hardware component of computers has, since the 1960s, evolved following a truism known as Moore's Law. Moore's Law is the formulation of an offhand comment made by Gordon Moore, co-founder of Intel, predicting that the "complexity for minimum component costs" of microchips had doubled every year since their introduction, and that this process would continue until 1975.³⁹ Expanding this law to include all information technology and expanding the time period to 18 months, this

³⁶ Hills, *Power From Steam*, 13, 16, 20

³⁷ *Ibid.*, 13, 16, 20

³⁸ Brynjolfsson and McAfee, *The Second Machine Age*, 6

³⁹ *Ibid.*, 40

law has held constant for over four decades.⁴⁰ The fact that this doubling process is an exponential one means that the process of improvement is accelerating all the time.

In 1997, for a cost of \$55 million, ASCI Red was the first computer to pass 1.8 teraflops, with the computer occupying 1,600 square feet and consuming enough power to run eight hundred homes. Within a decade, the Playstation 3 was also capable of 1.8 teraflops but for a cost of only five hundred dollars and the ability to run off a standard North American wall outlet.⁴¹ High-performance hardware is cheaper, more powerful, and more compact every 18 months. And every existing analog technology that incorporates computer technology and becomes digital, from sound recording to photography, has also become subject to Moore's Law and the exponential rate of increase.⁴²

Hardware has also recently been developed to enable new perception and manipulation abilities for computers as well. The Microsoft Kinect, developed to perceive human body motion to act as a controller for a game console, has been adapted to provide visual sensors for robotics,⁴³ and Google self-driving cars use a 64-beam laser rangefinder called a Cyclopean LIDAR to create a real-time 3D situational awareness of 100 meters surrounding the car.⁴⁴ A field of "soft" robots uses inflatable bodies and hands to allows robots to grip gently, jump, and fit into narrow spaces.⁴⁵

⁴⁰ Ibid., 40

⁴¹ Brynjolfsson and McAfee, *The Second Machine Age*, 40

⁴² Ibid., 42

⁴³ Ford, *Rise of the Robots*, 4

⁴⁴ Brynjolfsson and McAfee, *The Second Machine Age*, 55

⁴⁵ The Atlantic, "Cuddly Robots," *The Atlantic*, accessed March 28, 2016, <http://www.theatlantic.com/technology/archive/2016/03/hug-a-machine/475197/>

Despite the progress of hardware as a result of Moore's Law, it is in the software field where new advancements are allowing computers to compete with humans in more and more tasks.

The Imitation Game: New Software To Simulate Human Thought

These advances in hardware capability are an important foundation for enabling the immaterial layer of the computer, the software. The main power of the computer does not lie in its physical construction but in its ability to process data and complete tasks and operations. Alan Turing writes that a computer is generally divided into three parts: store, executive unit, and control.⁴⁶ Store is where information is contained, which can correspond to memory in a human. The executive unit is where the individual operations of a calculation are carried out. Control is the part that manages the instructions provided to the computer and ensures they are carried out in the proper order.⁴⁷ Turing explains that these features of a computer are independent of the hardware supporting them, using the example of a proposed Analytical Engine designed by Charles Babbage in 1839, a machine that used wheels and cards to complete mathematical calculations.⁴⁸ While of a completely different design principle than modern digital computers that use electricity, Turing states the underlying principle of store, executive unit, and control remain the same. The main advantage that an electric design has over Babbage's mechanical design is an ability to complete operations significantly faster than the Analytical Engine which Turing still considers superior to a

⁴⁶ A. M. Turing, "Computing Machinery and Intelligence," *Mind* 59(286) 1950, 437

⁴⁷ *Ibid.*, 437

⁴⁸ *Ibid.*, 439

human computer, a human computer being someone employed to complete mathematical operations and calculations for an organization.⁴⁹ Currently there is also research pursuing yet another model of computer, optical computing, which uses photons instead of electricity for digital processing and signal/imaging processing.⁵⁰ Despite these different hardware designs, the underlying structure of digital operations can be found in all three devices.

The exponential advance of hardware has opened up new possibilities for software, which changes in capability based on its complexity. Alderson, writing at the time of the steam engine's invention, wrote "it has been said that nothing made by the hand of man approaches so near to animal life."⁵¹ With computers, similar comparisons may now be made to human thought. The human brain is considered to be the most complex and powerful computing machine on Earth, but the basic neurons and conductors that make up the brain are anywhere from a thousand to a million times slower than an average integrated circuit.⁵² In other words, Moore's Law has already surpassed the hardware requirements of human thought. Yet despite this mechanical disadvantage, human thought is far more advanced than anything software can replicate, and in terms of general intelligence a top computer barely outperforms an insect.⁵³ What sets the human brain apart from computers, in purely technical terms, is analogous to software

⁴⁹ Ibid., 439

⁵⁰ Damien Woods & Thomas Naughton, "Optical Computing," *Applied Mathematics and Computing* 215 (2009), 1418

⁵¹ Hills, *Power From Steam*, 11

⁵² Ford, *Rise Of The Robots*, 72

⁵³ Ibid., 773

architecture. With the right software design complexity, even today's hardware could theoretically house increasingly powerful Artificial Intelligence (A.I.).⁵⁴

One key distinction to make is that the goal is not to exactly replicate human thought, but to replicate the behaviour of thought. Similar to how a steam engine is "near to animal life" but does not copy it, a human brain and a computer have some differences in process and different forms of judgement and decision making that make a direct comparison difficult. As mentioned, a digital computer is generally divided into three parts: store, executive unit, and control.⁵⁵ Although the store corresponds with memory, humans may forget information over time while computers have nearly perfect memory, such as accumulating large data propagation networks named "data lineages" that contain data, computations, and derived data processed over time.⁵⁶ Deleting data, such as a photo from a server or cloud service, must delete the entire data lineage of the photo, not just the original file. To forget data is a challenge, and computers must use forgetting systems and "unlearning" to determine which data to delete.⁵⁷ This is only one example of how software and human thought differ in process. Still, although internally they may differ, thought behaviour can be simulated, and Alan Turing states that digital computers "can in fact mimic the actions of a human computer very closely."⁵⁸ In other words, for a computer put to work in an occupation the focus should

⁵⁴ Ibid., 72

⁵⁵ Turing, "Computing Machinery and Intelligence," 437

⁵⁶ Yinzhi Cao & Junfeng Yang, (May 17-21, 2015) "Making Systems Forget With Machine Unlearning," presented at 2015 IEEE Symposium on Security and Privacy (SP), San Jose, CA, United States, doi: [10.1109/SP.2015.35](https://doi.org/10.1109/SP.2015.35), 1-2

⁵⁷ Ibid., 1-2

⁵⁸ Turing, "Computing Machinery and Intelligence," 437

be on the outcomes rather than the process, and computers can capably mimic those outcomes.

Turing encapsulates this distinction between replicating human thought and mimicking human thought behaviour by reformulating the question "can machines think?" into a thought experiment of whether a machine can beat a blind test he calls the Imitation Game, also known as the Turing Test.⁵⁹ In this test, a human attempts to judge between a human and a machine while unable to see the subjects and only communicating through writing, and the machine succeeds if the judge has as much difficulty as deciding between a man and a woman under similar circumstances.⁶⁰ The intention of this reformulation is to focus on thought as actions and outcomes rather than internal processes, and also separates the intellectual and physical characteristics of humans involved in the test so that the comparison is purely between the intellectual behaviours and outcomes of humans and machines under similar conditions.⁶¹ The question becomes, as Turing writes,

May not machines carry out something which ought to be described as thinking but which is very different from what a man does? ⁶²

One important thought behaviour that computers can mimic is learning, and the idea of software that can train itself and develop instead of being programmed as a finished product is one of the critical factors in software development that has pushed

⁵⁹ Ibid., 434

⁶⁰ Turing, "Computing Machinery and Intelligence," 434, 435

⁶¹ Ibid., 433

⁶² Ibid., 435

computers towards human capabilities. Turing suggests that to develop a machine capable of beating the Imitation Game it would be better to simulate the mind of a child and develop it to an adult level than to begin with the complete mind of an adult.⁶³ To develop its capability, the "child-programme" would be subject to the same amount of effort in education as a human child.⁶⁴ Turing concludes with the following:

It can also be maintained that it is best to provide the machine with the best sense organs that money can buy, and then teach it to understand and speak English. This process could follow the normal teaching of a child.⁶⁵

Written in 1950, this predicts both the necessity of sensing devices such as those discussed earlier, but also that learning has become a key development in automation software creation in the last decade. This is accomplished using a process known as Machine Learning, where a program is first exposed to one set of data known as a training set which the computer uses to program itself based on statistical patterns it discovers, and then the finalized program is applied to new sets of data using the capabilities it has developed from its training.⁶⁶ Chris Ackerson, an IBM solutions architect, describes this process as reversing traditional computing, where instead of a person providing inputs and their own programming logic, a cognitive machine is provided related inputs and outputs allowing it to develop its own internal logic

⁶³ Ibid., 455, 456

⁶⁴ Ibid., 456

⁶⁵ Turing, "Computing Machinery and Intelligence," 460

⁶⁶ Ford, *Rise Of The Robots*, 89

automatically.⁶⁷ An advanced form of this is known as Deep Learning, a process that has enabled computers to solve perceptual problems like image and speech recognition using two or more layers of artificial neural networks.⁶⁸ What sets Deep Learning apart from existing Machine Learning is that existing systems require supervision by humans and careful engineering. Deep Learning solves these problems by using a general-purpose learning procedure to independently discover defining characteristics and differentiating features in data, all while requiring "very little engineering by hand."⁶⁹ Deep Learning is a sequential process, where data informs one skill that later skills build on. In recognizing images of shapes, a program would first learn to recognize edges before adding understanding of corners and increasingly more complex shapes.⁷⁰ Each new distinguishing characteristic adds a new processing layer of understanding, and by adding multiple layers of modules a program could distinguish between pictures of a Samoyed dog and a white wolf in similar positions, due to the ability to recognize extremely minute detail.⁷¹

A similar approach can be found in robotics. Evolutionary Robotics is a field studying the robotic applications of evolutionary algorithms, which are algorithms that assess potential behaviours to optimize efficiency in accomplishing a task.⁷² The focus of

⁶⁷ Hayley Yudelman, "Your Guide to Cognitive Computing: An Interview with Solutions Architect Chris Ackerson," *IBM Watson Blog*, March 29, 2016, accessed April 1, 2016, <https://www.ibm.com/blogs/watson/2016/03/guide-cognitive-computing-interview-solution-architect-chris-ackerson/>

⁶⁸ Rusk, "Deep Learning," 35

⁶⁹ Yann LeCun, Yoshua Bengio, & Geoffrey Hinton, "Deep Learning," *Nature* 521, May 28, 2016, 436

⁷⁰ Rusk, "Deep Learning," 35

⁷¹ LeCun, Bengio, & Hinton, "Deep Learning," 438

⁷² Sylvain Koos, Jean-Baptiste Mouret, & Stéphane Doncieux, "The Transferability Approach: Crossing The Reality Gap In Evolutionary Robotics," *IEEE Transactions on Evolutionary Computation* 17(1), February 2013, 122

Evolutionary Robotics is on the behaviour of robots which develops from robot-environmental interactions, and successful implementation of this type of robotics depends on allowing robots to "live long enough to experience a large variety of environmental conditions."⁷³ Evolutionary algorithms allow robots to learn from their environments and their activities in those environments. This results in problem-solving robots that can adapt to changing conditions, such as an experimental hexapodal robot that when damaged learned to alter its locomotion behaviour using a learning process called T-resilience.⁷⁴ There is even a robot called Pepper which is "the first humanoid robot capable of recognizing principal human emotions and adapting his behaviour to the mood of his interlocutor," and the first humanoid robot to be adopted into Japanese homes.⁷⁵

These processes are perceived as mimicking human development and capability despite the differences in actual processes, and as Turing suggests the focus has been on achieving behavioural outcomes. This is seen in terminology, as the layers of modules in Deep Learning are referred to as "artificial neural networks" made up of individual "neurons."⁷⁶ Robotic behaviours from the application of evolutionary algorithms are also described in terms of human behaviour. When discussing the T-resilience algorithm and how it changes a damaged robot's locomotion behaviour without a self-diagnosis of what caused the damage, Koos et. al. write the following:

⁷³ Evert Haasdijk et. al., "Evolutionary Robotics," *Evolutionary Intelligence* 7, (2014), 69

⁷⁴ Koos, Cully, & Mouret, "Fast Damage Recovery In Robotics With The T-Resilience Algorithm," 1702

⁷⁵ "Who is Pepper?" accessed February 12, 2016, <https://www.aldebaran.com/en/cool-robots/pepper>

⁷⁶ LeCun, Bengio, & Hinton, "Deep Learning," 438

On a higher level, this concept could also share some similarities with what humans do when they are injured: if a movement is painful, humans do not fully understand what causes the pain, but they identify the behavior that causes the pain; once they know that some moves are painful, they learn to instinctively avoid them.⁷⁷

The more and more that A.I. and robots gain human characteristics and human capabilities, the more this technology can compete in similar areas. This has been a goal of IBM, for instance, who developed the chess computer Deep Blue which defeated Garry Kasparov in 1997. More recently, IBM developed a computer called Watson to compete on the game show *Jeopardy!* This game poses particular challenges to computers because it is not only a game that requires natural language recognition, but an understanding of puns, colloquialisms, and wordplay, as well as the rule unique to *Jeopardy!* of providing a question as a response to an answer.⁷⁸ When newly created, Watson was easily defeated by its human opponents in its first match in 2006, answering correctly only 15% of the time, while human competitor Ken Jennings responded correctly 90% of the time. By January 2011, Watson was vastly improved, buzzing first 43 times and answering correctly for 38 of them, while its human competitors Brad Rutter and Ken Jennings only managed to answer first 33 times between the two of them.⁷⁹ Watson is a cognitive computing platform built to harness the new capabilities of Deep Learning, and one example of the complex software that may begin to play a larger role in the economy of the future, competing with humans not just in games but for jobs.

⁷⁷ Koos, Cully, & Mouret, "Fast Damage Recovery In Robotics With The T-Resilience Algorithm," 1717

⁷⁸ Brynjolfsson & McAfee, *The Second Machine Age*, 24-25

⁷⁹ *Ibid.*, 26

The Changing Economic Context

While technological progress in the hardware and software of automation technologies have accelerated in the last ten years, how these devices and systems will affect people depends on the economic system those people inhabit, a system that is changing institutionally as well as technologically. Many of the same occupations still exist and many of the same institutions continue to go on as before, but the primary focus of economic growth is in the process of changing. In fifty years, the engine of economic growth in many advanced economies has switched away from manufacturing, but there is some debate over what it has changed to. Financialization and the globalization of finance is an important part of the shift as well, with a "revolutionary expansion" in financial transactions in the last thirty years since the collapse of Bretton Woods.⁸⁰ Finance extends beyond the economy into politics and society, with public policy and academic literature both treating financial markets as de-politicized and unstoppable forces that dictate government action, both national and international. States who "step out of line" from market will be "roadkill on the financial information superhighway."⁸¹

There are changes that have impacts on people's lives as well, with related trends in declining manufacturing and wage polarization all contributing to a hollowing-out of advanced economies such as the United States. Manufacturing jobs, the growth factor of industrial capitalism, have been key to the rise of the middle class as they are seen as "good" jobs that provided higher wages than other industries throughout the postwar

⁸⁰ Johnathan Kirschner, "Money is Politics," *Review of International Political Economics* 10(4) 2003, 646

⁸¹ *Ibid.*, 646

period. Manufacturing jobs still exist, and a process of "on-shoring" is bringing back many manufacturing jobs that were lost overseas through globalization, such as Whirlpool moving washing machine production and Otis moving elevator construction back to the US.⁸² Despite this, manufacturing in the 21st century is not the driver of growth that it was in the postwar period, and wages for manufacturing have lagged behind the private sector since 2006, rather than leading it as they did in the past. In the United States, the average hourly manufacturing wage is \$17.11, and even this average is supported by high wages in the upper percentile, rather than an even distribution.⁸³ According to Bureau of Labor Occupational Employment Statistics, the median wages of manufacturing and production workers are 7.7% lower than the average of the private sector as a whole, a trend that has accelerated since 2007.⁸⁴

This decrease in manufacturing job quality hurts the benefits of manufacturing as a growth sector that contributed to the economy as a whole. Local communities benefited from manufacturing jobs because a strong manufacturing sector produces direct and indirect spin-off jobs in other sectors like supply, transportation, retail, and restaurants.⁸⁵ This concept is also known as the Multiplier, developed by R.F. Kahn. Keynes describes the Multiplier as the relationship between *Primary Employment*, which is directly supported by investment, and total employment. So long as the marginal propensity to consume is high which means people consume a majority of new

⁸² Alana Semuels, "Good Job Aren't Coming Back," *The Atlantic*, accessed January 27, 2016, <http://www.theatlantic.com/business/archive/2015/10/onshoring-jobs/412201/>

⁸³ Catherine Ruckelshaus & Sarah Leberstein, *Manufacturing Low Pay: Declining Wages in the Jobs That Built America*, 6-7

⁸⁴ *Ibid.*, 6-7

⁸⁵ *Ibid.*, 3

income rather than saving it, the total amount of employment will exceed the amount of directly created jobs.⁸⁶ If manufacturing jobs provide high wages, and the marginal propensity to consume is high, support industries and indirect employment can also benefit from well-paid manufacturing jobs. If wages in manufacturing are lagging the private sector, manufacturing is less able to drive the multiplier as an engine of growth.

Manufacturing jobs were also important in supporting the income of the middle class, and at the same time that manufacturing wages are falling, the middle class is shrinking. A Pew Research Center study in 2015 found that after four decades of being the economic majority in the United States, the middle class declined to equal to lower- and upper-income tiers.⁸⁷ Middle-income here is defined as adults making two-thirds to double the national median of \$42 000. The population of middle-income earners has also fallen slowly, and they have been completely overtaken in aggregate income earned. 49% of aggregate income of the US has shifted towards upper income earners, compared to 43% for middle-income earners. For comparison, in 1970 middle-income earners accounted for 62% of aggregate income, while upper-income earners accounted for 29%.⁸⁸ As manufacturing wages lag relatively compared to their past performance, middle-class jobs do not return leading to increasing inequality and this gradual erosion of the middle class compared to the height of the manufacturing industry.⁸⁹

⁸⁶ John Maynard Keynes, *The General Theory of Employment, Interest, And Money* (San Diego: Harcourt, 1991), 113

⁸⁷ Pew Research Center, "The American Middle Class is Losing Ground," accessed January 23, 2016, <http://www.pewsocialtrends.org/2015/12/09/the-american-middle-class-is-losing-ground/>

⁸⁸ Ibid.

⁸⁹ Ruckelshaus & Leberstein, *Manufacturing Low Pay*, 15

Employees are also facing falling income from reduced hours as well as reduced wages. Another factor that affects people in the changing economy is the rise of job precarity, the replacement of traditional careers with short-term, part-time employment. Precarious work involves work schedules that are unpredictable, unstable, or unwanted, and precarious work scheduling can hinder the ability of workers to arrange caregiving, pursue education, secure a second job, or earn an adequate income, and can negatively affect worker health.⁹⁰ Manufacturing is no exception, as many firms have turned to temporary staffing agencies to fill workers on an as-needed basis with no guarantee of a full-time position, with staffing agencies now providing 1.4 million manufacturing workers, which made up 44% of staffing agency positions in 2006.⁹¹ Some jobs are organized around "zero-hour" contracts with no guaranteed hours at all but a requirement to always be "on-call" and ready to work at a moments notice, meaning people can find themselves employed but without work or income.⁹² This allows companies to treat labour as a variable cost, rather than a fixed one, putting them to work only when needed.⁹³

The recession after 2008 has been used to explain high unemployment rates and low labour force participation rates in the years following. Despite this, the economic aftereffects of the last three US recessions of 2008, 2001, and 1990 have been different than earlier recessions, mirroring a change in European post-recession employment

⁹⁰ Susan J. Lambert et. al., *Precarious Work Schedules among Early-Career Employees in the US*, Chicago: Employment Instability, Family Well-Being, and Social Policy Network, University of Chicago, August 27, 2014, accessed April 15, 2016, <https://ssascholars.uchicago.edu>, 1-2

⁹¹ Ruckelshaus & Leberstein, *Manufacturing Low Pay*, 13

⁹² Gorz, *Reclaiming Work*, 93

⁹³ Anthony B. Atkinson, *Inequality: What Can Be Done?* (Cambridge, Massachusetts: Harvard University Press, 2015), 135

recovery away from V-shaped dips and rapid recovery towards prolonged and persistent unemployment, each recession slower than the last to recover.⁹⁴ Yann Moulier Boutang describes the recovery from the 2008 crash as temporary, fearing a second crash "like the second dip of a floppy W," and that the crash was not a V-shaped blip leading to the next wave of growth.⁹⁵ If the effects and behaviour of recessions are changing as well, recessions may be a symptom rather than a cause of change. A paper by Coibon, Gorodnichenko, and Koustas found that traditional explanations for prolonged post-recession unemployment like monetary and fiscal policy were called into question, and that "there must be additional, more powerful factors at work."⁹⁶ Changing demographics and changing attitudes on claiming government benefits can quantitatively drive some increased persistence, but the paper suggests this should have been offset by other factors.⁹⁷

The economy is changing, and creating pressures for individuals who are a part of it. Understanding the changes in the economy, and the forces acting upon people within it, will help to understand the reaction people have to automation technology.

⁹⁴ Olivier Coibon et. al., *Amerisclerosis? The Puzzle of Rising US Unemployment Persistence*, 194

⁹⁵ Moulier Boutang, *Cognitive Capitalism*, 39-40

⁹⁶ Coibon et. al., *Amerisclerosis?* 236-7

⁹⁷ Coibon et. al., *Amerisclerosis?* 237

The Issue Lies Where the Two Trends Meet

While these two trends of rapidly advancing technology and an evolving economy overlap in many ways, one common aspect in particular stands out to people: both trends have an impact on employment. The more technology advances and can accomplish the same tasks as people, the more people will compete with machines for the chance to accomplish those tasks, and in an economy where work is depended upon more and more while it is also becoming harder to secure and more precarious when a job is found, there may be unease and fear of more competition, especially in an already fractious job market. It is not a minority making the association between technology and employment, either: a Pew Research survey published on March 10, 2016, showed that 65% of Americans believe that robots and computers will "probably" or "definitely" replace much of the work currently done by humans in fifty years, while 32% believe it will "probably not" or "definitely not" happen.⁹⁸

Despite this association, this idea has not yet contributed to any change in policy or theory. In the same 2016 Pew survey where a majority of Americans felt automation would replace many occupations, 80% of those surveyed believed that their own employment was resistant to the same trends.⁹⁹ Perhaps the high-level idea of widespread automation has not yet been identified with day-to-day life or has been associated with a more distant future. Or, since many of the new technological developments have only come about from rapid development in the last five to ten years, the implications of technological change may not be fully understood.

⁹⁸ Aaron Smith, "Public Predictions for the Future of Workplace Automation," *Pew Research Center*, March 10, 2016, accessed May 6, 2016, <http://www.pewinternet.org/2016/03/10/public-predictions-for-the-future-of-workforce-automation/>

⁹⁹ Ibid.

But if it becomes understood as a more real and immediate possibility, what sort of change in policy or theory should result? Automation is context specific, and introduced into today's urbanized world with its dependence on income and employment is different from the time of Keynes or Marx. Understanding an economy as described earlier in its most developed theoretical form is the first step, and integrating it with theoretical conceptions of the automation process will better allow for an assessment of what kind of policies can be used to ensure potential widespread labour substitution is not harmful to society.

2. The Current Economy as Cognitive Capitalism

A Transition From Industrial Capitalism To Cognitive Capitalism

The economic trends referenced in the previous chapter, of a move away from manufacturing, a decline in the middle class, and increasing precarity of employment, may point towards a larger change in the economy that is not explained by recessions and their aftermath. In some analyses, information technology is portrayed as the key factor. This view of technology as an agent, with markets and society reacting to its changes rather than causing them, is common in descriptions of both the industrial revolution and the current economy when it is described as either a "knowledge economy" or "information society."¹⁰⁰ Classical microeconomics portrays technology as a determining factor of the supply curve, an independent variable that can redefine market equilibrium.¹⁰¹ Technologies are a sign of progress, and produce liberation of the human spirit "almost as a by-product."¹⁰² New digital information technologies are described as the heart of a new dynamic growth sector, a technical revolution driving high productivity and becoming the general paradigm of the new economy.¹⁰³

This technological determinism normalizes technological change as "unavoidable but ultimately socially beneficial," where humans as users must adapt.¹⁰⁴ Approaching technological change in this way limits debate about change, as technology is an

¹⁰⁰ Moulrier Boutang, *Cognitive Capitalism*, 39-40

¹⁰¹ N. Gregory Mankiw, Ronald Kneebone, & Kenneth McKenzie, *Principles of Microeconomics* (Toronto: Nelson Education, 2011), 80

¹⁰² Christopher May, *The Information Society: A Sceptical View* (Cambridge UK: Polity Press, 2002), 20

¹⁰³ Moulrier Boutang, *Cognitive Capitalism*, 41-42

¹⁰⁴ May, *The Information Society*, 21

inevitable force is not subject to human control. But where does the technological change come from? An alternative is to view technological progress in the context of the economy and society in which it develops, as well as the human choices and incentives that direct which technologies are developed. A version of this can be seen in the work of Bruno Latour, who critiques modernity as artificially separating humans and their social world from the natural world of "things," even when there can be hybrids of the two.¹⁰⁵ Technological determinism of the sort used to promote the current economy as a clean break from the past depends as much on technological change as it does on an assumption that in the face of new technology humans will react passively and accommodate, rather than influencing the technology in return.¹⁰⁶

Yann Moulier Boutang, in his book *Cognitive Capitalism*, and authors such as Carlo Vercellone, Jean-Marie Monnier, and Andrea Fumagalli, develop a theoretical framework that approaches technological change with a less deterministic approach, as well as addressing the decline of manufacturing and rising labour precarity. Cognitive Capitalism is an unstable hybrid system, adopting a new basis of economic growth in cognitive and knowledge work, but preserving the old systems of accumulation and organization from capitalism. Moulier Boutang describes it as both a coherent system and a dynamic process of change, not a "new economy" so much as a reorganization of the old economy around new sources of growth.¹⁰⁷ This transition in the economy is

¹⁰⁵ Bruno Latour, Catherine Porter, trans. *We Have Never Been Modern* (Cambridge, Massachusetts: Harvard University Press, 1993), 13-14

¹⁰⁶ Christopher May, *The Information Society: A Sceptical View*, 24

¹⁰⁷ Moulier Boutang, *Cognitive Capitalism*, 47-48

only the latest in a series of paradigm shifts from one economic system to the next, but the most recent transition is not a total break from the previous paradigm.

Marx writes that this latest transition from the industrial economy begins when the worker "inserts the process of nature, transformed into an industrial process, as a means between himself and inorganic nature, mastering it. He steps to the side of the production process instead of being its chief actor." The transformed "process of nature" is technology, as machines accomplish tasks "out of all proportion to the direct labour time spent on their production," and their increasing importance means that the creation of real wealth comes to depend "on the general state of science and on the progress of technology, and the application of this science to production."¹⁰⁸

This change has significant implications for the foundations of capitalism, as Marx then argues:

"In this transformation, it is neither the direct human labour he himself performs, nor the time during which he works, but rather the appropriation of his own general productive power, his understanding of nature and his mastery over it by virtue of his presence as a social body - it is, in a word, the development of the social individual which appears as the great foundation-stone of production and of wealth. The theft of alien labour time, on which the present wealth is based, appears a miserable foundation in face of this new one, created by large-scale industry itself. As soon as labour in the direct form has ceased to be the great well-spring of wealth, labour time ceases and must cease to be its measure, and hence exchange value [must cease to be the measure] of use value. The surplus labour of the mass has ceased to be the condition for the development of general wealth, just as the non-labour of the few, for the development of the general powers of the human head. With that, production based on exchange value breaks down, and the direct, material production

¹⁰⁸ Marx, *Grundrisse*, Notebook VII, 704-705

process is stripped of the form of penury and antithesis. The free development of individualities, and hence not the reduction of necessary labour time so as to posit surplus labour, but rather the general reduction of the necessary labour of society to a minimum, which then corresponds to the artistic, scientific etc. development of the individuals in the time set free, and with the means created, for all of them.¹⁰⁹

Marx predicted that this change from labour in general as a source of value to technology guided by society's collective knowledge and certain labour supporting this technology as the source of value would result in capitalism's demise; Cognitive Capitalism, on the other hand, examines how this transition could occur without this collapse of capitalist institutions and structures. The resulting system is unstable due to contradictions resulting from the preservation of some of the institutional structures of industrial capitalism, even when the concepts they depends on are no longer relevant or measurable.

Cognitive Capitalism theory also refrains from technological determinism, with Moulner Boutang describing determinism's weakness as giving the social uses of technology a secondary role. Without human knowledge or skills to set them in motion, "technology itself produces nothing by way of development or growth."¹¹⁰ Humans are the original source of knowledge and ideas, determining what tasks should be accomplished. We can also see this in Marx's view of technology as mankind's mastery of science is what allows the laws of nature to be harnessed and put to work. The application of technology may have implications for the structure of the economy, but as

¹⁰⁹ Marx, *Grundrisse*, Notebook VII, 705

¹¹⁰ Moulner Boutang, *Cognitive Capitalism*, 42

the second half of a mutual relationship where technology itself comes from human action.

There is another economic argument for the declining profitability of material production: material goods are subject to the law of diminishing returns. Eventually economic growth can no longer be found in more efficient manufacturing by increasing productivity, as an affluent economy means the exchange value of produced goods declines over time, and eventually this trends towards the limit of a no-cost economy.¹¹¹ To continue growing the economy, a new source of growth must take the place of manufacturing. The answer is that this principle applies mainly to private goods that are physical, so moving beyond material goods allows companies to escape physical scarcity as a barrier to economic growth.¹¹² While material goods remain critical to the economy they are no longer central for pricing or valorization, used instead as vehicles for immaterial goods like knowledge and brands.¹¹³ Companies will often outsource production of material goods to subcontractors while the remaining core of the company focuses on creative work, like design, branding, and marketing.¹¹⁴ This helps to explain the low wages of manufacturing described earlier, even though the jobs may be returning from overseas and productivity is increasing. The challenge for capitalism is that while shifting focus to immaterial production escapes the limits of scarcity, it sets

¹¹¹ Gorz, *The Immaterial*, 55

¹¹² Moulier Boutang, *Cognitive Capitalism*, 65

¹¹³ Gorz, *The Immaterial*, 72

¹¹⁴ *Ibid.*, 58

up a crisis in the law of labour-value.¹¹⁵ This in turn affects how the gains from economic growth are distributed.

Immaterial Goods And The Marginal Utility Theory of Value

There are two facets of why establishing the value of goods is difficult in Cognitive Capitalism, one relating to the nature of the goods produced and the other related to the labour that produced them. The first relates to how the price of goods are set, which affects the income earned from their sale. Industrial capitalism developed certain measures to establish value, but with the change towards immaterial goods, those methods no longer apply and new ways of measuring goods needed to be developed.

As a consequence of being unrestricted by physical scarcity, the immaterial market exists outside of the market rationality of physical goods, and resists the traditional valorization methods used in industrial capitalism. In modern economics, goods are classified by asking 1) is the good excludable, and 2) is the good rival in consumption?¹¹⁶ Information and knowledge is not a natural resource, because it is non-rival: one person's use of a knowledge good does not consume the knowledge good or prevent others from using it as well.¹¹⁷ This also disqualifies information goods from another important category: private goods. Private goods are goods that are both excludable and rival in consumption. These goods also make up most of the goods in the market economy, to such an extent that when the concepts of supply and demand in

¹¹⁵ Carlo Vercellone, "From Formal Subsumption to General Intellect: Elements for a Marxist Reading of the Thesis of Cognitive Capitalism," *Historical Materialism* 15 (2007), 16

¹¹⁶ Mankiw, Kneebone, & McKenzie, *Principle of Microeconomics*, 230

¹¹⁷ Brynjolfsson & McAfee, *Second Machine Age*, 62

microeconomics are used, they implicitly assume that products in such a market are private goods.¹¹⁸ But knowledge goods do not fall in this category, meaning that for them this assumption in economics no longer holds and supply and demand cease to operate as they do for private goods in economic theory.

Knowledge is expensive to collect and codify into information but costs comparatively little to reproduce: it is a zero-marginal cost product. Writing and producing a song or researching and presenting a lecture are resource- and cost-intensive exercises, requiring facilities, time, and individual effort. Once recorded and transcribed to digital format, however, a computer can copy digital files almost infinitely, limited only by storage space, and since most information goods are now digital rather than analog and computer ownership is common, almost any user has the ability to do this. If price is set according to the theory of supply and demand, the ability to increase supply nearly infinitely means prices are hard to set for immaterial goods, whether songs or movies or software. Immaterial goods escape the law of diminishing returns by overcoming scarcity, but without scarcity the traditional industrial capitalist price structure is called into question.¹¹⁹

If a knowledge good is not a private good or a natural resource, which type of good is it? In ruling out the previous two categories, only the question of whether knowledge goods are rival in consumption was addressed. This is because the excludability of knowledge goods is a point of contention. If knowledge goods cannot exclude consumers, then they are public goods like clean air or national defense. If they can be

¹¹⁸ Mankiw, Kneebone, & McKenzie, *Principle of Microeconomics*, 230

¹¹⁹ Moulner Boutang, *Cognitive Capitalism*, 103

excludable, then they become natural monopolies, where one company becomes the sole provider of a good.¹²⁰ Even this distinction is difficult to make, however, as knowledge goods are not easily excludable through scarcity or other natural means, but are rendered artificially excludable, mainly through government intervention but partially through social means.

Cognitive Capitalism argues companies have addressed the value and pricing problem by using property rights and social monopolies as rentier mechanisms to recreate scarcity artificially and reinstitute the price structure. Intellectual property rights are not a recent development, for instance being enshrined as a power of Congress in the US Constitution:

To promote the Progress of Science and the useful Arts, by securing for limited Time to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."¹²¹

The original purpose of intellectual property rights, as in the US Constitution, is to incentivize innovation and experimentation and maintain technological and social progress, as well as enabling the commercialization of inventions. This incentive is to allow the holder of the right a period of legal monopoly during which time they can recoup the development costs, which is especially important for goods with no marginal cost.¹²² Although the Constitution specifies inventors and authors, these rights can now be held by corporations as well, with IP making up 33% of the value of US

¹²⁰ Mankiw, Kneebone, & McKenzie, *Principle of Microeconomics*, 231

¹²¹ *US Constitution*, Art.I, § 8, Web

¹²² The White House, *Economic Report of the President*, (Washington D.C.: Superintendent of Documents, U.S. Government Printing Office, February 2006), 213

corporations.¹²³ The 2006 Economic Report of the President, which contains a detailed description of intellectual property rights in the US context and why intellectual property differs from other forms of property, argues that intellectual property rights are "an important element of the American economy and can contribute to the economic growth of all countries."¹²⁴

There are four types of intellectual property protection in the United States, three of which are protected at the federal level: patents, trademarks, and copyrights. Intellectual concepts, mental processes, and basic laws of nature are exempt from intellectual property, as only particular representations, implementations, or expressions of an idea are permitted after fulfilling specific criteria defined by intellectual property laws.¹²⁵ Patents protect the implementation of an idea through inventions or innovations for a period of 20 years, and the more novel a product is the broader its protection can be.¹²⁶ A copyright protects the expression of an idea, such as books, paintings and other "expressive work" for the life of the author plus 70 years, or for anonymous works either 95 years from publication or 120 years from creation, whichever is shorter.¹²⁷ Trademarks protect symbols of an idea, such as the unique identifiers of a product or service, and last as long as the identification holds, being lost through discontinued use or if the symbol becomes too generic.¹²⁸ It has always been

¹²³ Ibid., 219

¹²⁴ The White House, *Economic Report of the President*, February 2006, 211

¹²⁵ Ibid., 215

¹²⁶ Ibid., 216

¹²⁷ Ibid., 215

¹²⁸ Ibid., 217

recognized that the protection period should be limited in duration as seen in the copyright and patent time limits, or these rights could lead to monopoly situations and could slow the rate of technological development in a country.¹²⁹

Businesses have been enforcing property rights over new immaterial products by strengthening these existing institutions. For instance, chemical, pharmaceutical and information technology companies, as well as software, entertainment, and publishing are extremely dependent on these protections for compensation.¹³⁰ These mechanisms grant firms the right to part of the value generated by factors external to themselves by virtue of ownership, and are used to create artificial scarcity in abundant goods by legally forbidding when, where and by whom a good might be accessed, giving the owner of the legal instrument the right to decide. Companies use this as a mechanism to demand rent from anyone who wishes to access or copy the protected good, and as a result value becomes subject to power relations, specifically command over markets as a whole rather than command of the factors of production.¹³¹ This is for the purpose of attributing value to goods resistant to traditional valorization, but this also gives new powers to companies who wield the legal rights. Physical scarcity affects everyone equally, individuals and companies alike. Artificial scarcity, on the other hand, can discriminate. While this use of property rights to convert social value into an economic good with monetary value has forestalled the problem of assessing value, it sets up a creeping crisis of property rights.¹³²

¹²⁹ Ibid., 214-215

¹³⁰ The White House, *Economic Report of the President*, 215

¹³¹ Vercellone, "The Becoming Rent of Profit," 272-273

¹³² Moulier Boutang, *Cognitive Capitalism*, 100-101

Absent the rentier mechanism, there is no stable way to valorize immaterial goods. Companies attempt to use brands and public image to create social monopolies, to convince consumers of a product's desirability using factors other than price like identity and prestige. This allows companies to continue charging prices above a market average and collect profits on goods with low marginal costs when the public's tastes identify with the brand.¹³³ To price this fluctuating value, firms turn to financial markets for external valorization. For some companies their stock market pricing is largely based on the company brand's valuation, and in some cases brands are their own stock, separate from that of the company. Examples include the Boston Pizza Royalties Income Fund (BPF.UN) and Pizza Pizza Royalty Corp. (PZA), both of which own the trademarks and trade names of their respective restaurants and are publicly traded on the Toronto Stock Exchange.¹³⁴ An added benefit of this brand loyalty or goodwill is that, as immaterial goods with no intrinsic value beyond what is assigned subjectively, there is no upper limit to what their value can be so long as sentiment holds. Other intangible assets include organizational efficiencies, and firm specific human capital, and combined intangible assets were estimated to account for 70% of the stock value of publicly traded companies in 2006, with branding and trademarks estimated to be 14%.¹³⁵ With the potential for volatility, the mechanisms this form of valuation has been made possible by computer trading, as computers allow investors to feel secure knowing they can engage and disengage quickly.¹³⁶ This only works for setting a price and not for

¹³³ Moulier Boutang, *Cognitive Capitalism*, 32

¹³⁴ "Listed Company Directory," accessed on January 16, 2016, <http://www.tsx.com/listings/listing-with-us/listed-company-directory>

¹³⁵ The White House, *Economic Report of the President*, 218

¹³⁶ Moulier Boutang, *Cognitive Capitalism*, 141

establishing value, however, and with pricing now assigned subjectively through market control and reputation, at risk of high-speed shifts, the system becomes highly unstable.

If wealth can be created through positive sentiment, reputation, or control, it can easily be destroyed by the loss of those factors, since the assignment of value to any of them through traditional accounting methods amounts to guesswork. Companies with a perception that they are innovative, respected, and in control of positive network externalities can command incredibly high valuations, but the loss of this perception for any reason can cause this value to drop to near-zero.¹³⁷ If the difference between monopoly pricing and near-zero valuations is decided by sentiment, what is the intrinsic value of immaterial capital and knowledge goods independent of outside attitudes? This crisis of value has important ramifications for people. In the short-term is finance, where the rise and fall of markets can spill over into other sectors. With a large enough loss of confidence and change in sentiment, the entire economy can be put at risk.¹³⁸

In practice, a problem determining value to set prices also affects wages, since wages are paid out of the revenue earned, and in classical terms are proportional to the marginal product of labour in a firm in a competitive market.¹³⁹ This pricing method is known as "marginal-utility theory."¹⁴⁰ With a marginal-utility approach used to explain how prices in production are set, this means determining wages and prices rely on the same measurements. Figuring out which part of the price is owed to workers when the price is set independently of their input makes this far more difficult.

¹³⁷ Moulier Boutang, *Cognitive Capitalism*, 140-141

¹³⁸ Moulier Boutang, *Cognitive Capitalism*, 146, 179

¹³⁹ Keynes, *The General Theory of Employment, Interest, and Money*, 5

¹⁴⁰ Paul Mason, *Postcapitalism* (New York: Farrar, Strauss And Giroux 2016), 159-161

Cognitive Work and The Labour Theory of Value

This leaves the second reason that value is difficult to set with immaterial production, and this applies to the labour process itself and the other means of evaluating wages and labour's contribution, Marx's law of value. In the alternative Marxist theory of wages, the wage is a product of the labour power consumed in the production process, and the cost of reproducing that labour or crystallizing it in fixed capital for the next cycle.¹⁴¹ However, while Marx's Labour Theory of Value is important for understanding the labour process and how pricing occurs, it is not a practical tool for measuring pricing and predicting price movements, so the measurement problem remains.¹⁴² To Marx the source of profit in capitalism comes from the expropriated surplus labour of workers, but since the source of profit is no longer individual labour but the collective knowledge of society, this means that accurately measuring labour directly as production per time unit is no longer possible as it was under industrial capitalism.

Cognitive Capitalism argues that the ultimate source of value in knowledge production stems from the intellectual commons or General Intellect. Karl Marx was the first to coin and apply the term General Intellect, referring to the sum of social networks, scientific knowledge, and human activity of knowledge and social production in society which becomes "a direct a force of production."¹⁴³ Marx writes that as technology becomes a larger and larger part of production and the economy, it is the organizations with access to the most developed scientific knowledge able to drive new

¹⁴¹ Moulier Boutang, *Cognitive Capitalism*, 94

¹⁴² Mason, *Postcapitalism*, 156

¹⁴³ Marx, *Grundrisse*, Notebook VII, 706

technology and productivity that become the most profitable. The continued generation of wealth in the economy thus comes to depend on "the general state of science and on the progress of technology, or the application of this science to production."¹⁴⁴ Society's knowledge guides the creation of the machinery and fixed capital in the economy, as all technology from railways to telegraphs are "organs of the human brain, created by the human hand; the power of knowledge, objectified."¹⁴⁵

In this dissertation we can then consider the General Intellect as both a repository of a society's formal and experiential knowledge, and the ongoing social process of diffusing and building upon that knowledge so that it can be used to produce new knowledge, like Newton standing on the shoulders of giants. The General Intellect can include social networks, academic institutions, and the sum total of the "social individual" and their presence as a collective "social body."¹⁴⁶ The accumulation of knowledge would be impossible with the relational activity of the General Intellect, as individual knowledge accumulation cannot generate knowledge as a commodity or productive knowledge growth.¹⁴⁷ The appearance of the diffuse intellectuality corresponding to the General Intellect as a primary factor in production is a sign that industrial capitalism has transitioned towards Cognitive Capitalism.¹⁴⁸ Labour still exists as a process internal to the firm, but the source of wealth is not the labour itself

¹⁴⁴ Marx, *Grundrisse*, Notebook VII, 704-705

¹⁴⁵ Ibid., Notebook VII, 706

¹⁴⁶ Ibid., Notebook VII, 705

¹⁴⁷ Fumagalli & Morini, "Life Put To Work: Towards A Life Theory of Value," 238

¹⁴⁸ Vercellone, "From Formal Subsumption to General Intellect," 16

but "the agencies set in motion during labour time," so that the profit generation of internal labour depends on the externalities of the General Intellect.¹⁴⁹

This change means that labour has changed from the production of value to the embodiment of value, a measure in and of itself. Labour in industrial capitalism was valued based on the production of goods and services during a discrete period of time within the precise limits of a job.¹⁵⁰ Wealth was created through the process of labour, and prices were set according marginal cost theory. As material goods approach zero-marginal cost, and immaterial production becomes the center of economic growth, measuring the productivity of a workforce using labour-time calculations and measuring the pricing using marginal cost is no longer possible. Services like caregiving, education, and innovation resist division into time units, and for some the duration extends throughout the lifespan of the person. In other words, wealth is embodied in the work and the workforce rather than the product of their work, and the source of value becomes the General Intellect, where knowledge creates new knowledge at a societal level.

This helps little with determining the contributions on an individual basis, a practice preserved from industrial capitalism. The General Intellect is a collective social factor beyond an individual and their working hours, so that even though an employee may be physically present in a workplace for a set period of time, the total cognitive effort that was put to work in the final product may involve factors external to the workplace.¹⁵¹ Cognitive labour involves free time as well, extending into a person's life,

¹⁴⁹ Marx, *Grundrisse*, Notebook VII, 704

¹⁵⁰ Moulier Boutang, *Cognitive Capitalism*, 164

¹⁵¹ Vercellone, "From The Mass Worker to Cognitive Labour," 170

their experiences and particularly their relationships. Positive externalities mean that the collective product is greater than the sum of the individual effort alone. The institutional response from employers to this challenge has been to ignore the inputs and focus on defining outcomes. How much work and what kind of work is done ceases to matter so long as the desired result is achieved, per job or per project.¹⁵²

This kind of environment leads to a superstar effect, where a small group of workers known for their skills and sought after by employers are rewarded for their efforts, while the vast majority are left unrecognized, with more precarious jobs.¹⁵³ In a market economy, consumers or employers are often drawn to the product or an employee of the best quality. Usually constraints such as limited availability, information asymmetry, or geographical locality prevent one candidate from cornering the market, but without these constraints one quality provider can compete in the whole market.¹⁵⁴ The global reach and low cost of digitally networked markets are particularly susceptible to winner-take-all distributions, where "only a few succeed but those who do can amass stupendous fortunes."¹⁵⁵ Companies in these sectors can service the entire global market, while service firms and physical labour can only efficiently service people in a limited geographical area. A talented programmer who becomes well-known can completely dominate the market with their products, as no one will settle for another product when the best is available.¹⁵⁶ The low reproduction costs of information are

¹⁵² Yann Moulier Boutang, *Cognitive Capitalism*, 2011, 164, 165

¹⁵³ Vercellone, "From The Mass Worker to Cognitive Labour," 186-187

¹⁵⁴ Brynjolfsson & McAfee, *Second Machine Age*, 153

¹⁵⁵ Lanier, *Who Owns The Future?* 39

¹⁵⁶ Brynjolfsson & McAfee, *Second Machine Age*, 154

another culprit because they remove the capacity constraints of goods production: immaterial goods that are not rival in consumption can never be out of stock. There is little need to pay a band to play a cover of a song if an original song can be copied for near-zero cost, and even if someone offered to sing a song for free, people would still likely pay to hear a popular music star sing the song instead.¹⁵⁷ People who can leverage digital networks in this way can generate high incomes, but this leaves little room for competition in the same niche.

If it becomes difficult to assess the value of an individual's work, this directly leads to problems in payment, what Moulier Boutang terms a "constitutional crisis of work."¹⁵⁸ Labour in cognitive capitalism is still subject to the wage relationship as a time-based remuneration of labour, even though time no longer works as a descriptive element of work. Wages in industrial capitalism are paid out of the revenue made from the production of goods and services during a discrete period of time, such as widgets produced per hour or customers served per day. As material goods approach zero-marginal cost, and immaterial production becomes the centre of economic growth, measuring the productivity of a workforce using these labour-time calculations is no longer possible. Services like caregiving, education, and other cognitive work resists "chopping up" into time units, as their continued production value depends on the work continuing for a sustained period of time, and comparing end results with initial objectives to determine success is not possible.¹⁵⁹

¹⁵⁷ Brynjolfsson & McAfee, *Second Machine Age*, 154

¹⁵⁸ Moulier Boutang, *Cognitive Capitalism*, 16

¹⁵⁹ *Ibid.*, 75

As wages from work are the primary means of income for the vast majority of society, being unable to accurately determine fair individual compensation for collective work has an effect on access to income. The ultimate result of these trends is the division of cognitive labour into two classes. Those who secure a well-paying, steady job in the creative core of a company, financial services, or legal advice around intellectual property enjoy full recognition of their abilities and the full benefits of pensions and healthcare. The rest, who make up the majority of the workforce, supply low-paying cognitive work and the neo-Taylorist support services that cognitive work depends on but does not directly produce economic growth, often working at extremely low wages.¹⁶⁰ The persistence of the wage relationship is also what drives the precarious nature of employment, since the jobs differ from the jobs that the wage relationship was originally meant to incorporate.¹⁶¹

This does not necessarily mean that there is less measured employment. Unemployment rates in the United States have been falling since 2009/10, reaching 5.0% in December 2015.¹⁶² Cognitive capitalism instead means that the composition of the labour market is changing, starting with the loss of "good" middle-class jobs in manufacturing and their replacement with lower-paying and less stable work. This did not start with the 2008 recession, but has been a longer-term process.

For instance, in the last twenty years there has also been a steady increase in self-employment. In the second quarter of 1970, there were a total of 5.132 million

¹⁶⁰ Vercellone, "From The Mass Worker to Cognitive Labour," 186-187

¹⁶¹ Vercellone, "From Formal Subsumption to General Intellect," 31

¹⁶² Bureau of Labour Statistics, "Labor Force Statistics From Current Population Survey #LNS14000000, Seasonally Adjusted Unemployment Rate," Accessed January 25, 2016, <http://data.bls.gov/timeseries/LNS14000000>

nonagricultural unincorporated self-employed workers in the US. The previous peaks, since data was first collected in 1948, were in 1949 and 1960 at around 6.4 and 6.5 million. The number of self-employed individuals has not passed below 8 million since 1987 (see Figure 2-1).¹⁶³

Figure 2-1



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These make up some of the jobs described by Moulier Boutang and Vercellone at the low end of the new labour market, and new forms of self-employment have appeared in the last ten years, enabled by smartphones and digital networks. Self-employment includes many of the new jobs in the "sharing economy," an economy where tasks and property are shared through digital applications on smartphones that

¹⁶³ Federal Reserve Bank of St. Louis, "Employment Level: Nonagriculture, Self-employed Workers, Unincorporated (1948-2015)," accessed January 19, 2016, <https://research.stlouisfed.org/fred2/series/LNU02032192>

¹⁶⁴ Ibid.

serve as networks.¹⁶⁵ Examples of companies include Uber, Postmates, SkipTheDishes, and Washio.¹⁶⁶ These types of self-employed position are also becoming more common: one TIME poll found that 45 million American adults have offered a self-employed service through one of these platforms, with one third of these describing their work in the sharing economy as a primary income or making up more than 40% of their income.¹⁶⁷ These jobs are often low-paying, and because workers are considered self-employed, do not include benefits and are not taxed, placing the responsibility for these services on the worker. These companies often go through great efforts to maintain the self-employed category in order to continue to skirt labour laws, and technology enables them to do so much more easily.¹⁶⁸ Companies in this sector argue that they are neutral technology platforms that enable individuals to transact services rather than employers of these individual, although decisions such as one by the California labor commissioner in 2015 could challenge the legality of this model in some jurisdictions.¹⁶⁹

This forms part of a larger trend towards contract work and a decline in core employment. Economists Lawrence Katz and Alan Krueger found that the amount of American workers in "alternative work arrangements" increased by 9.4 million workers, from 10.1% of jobs in 2005 to 15.8% in 2015, with 0.5% of this growth representing

¹⁶⁵ Eric Newcomer & James Nash, "A California Ruling Just Challenged Uber's Entire Business Model," *Bloomberg Business*, June 17, 2015, accessed February 28, 2016, <http://www.bloomberg.com/news/articles/2015-06-17/uber-driver-was-employee-california-labor-commissioner-says>

¹⁶⁶ Andrew Callaway, "Apploitation in a City of Instaserfs," *CCPA Monitor*, January 2016, 21

¹⁶⁷ Katy Steinmetz, "See How Big The Gig Economy Really Is," *TIME Magazine*, January 6, 2016, accessed March 29, 2016, <http://time.com/4169532/sharing-economy-poll/>

¹⁶⁸ Callaway, "Apploitation in a City of Instaserfs," 21

¹⁶⁹ Newcomer & Nash, "A California Ruling Just Challenged Uber's Entire Business Model,"

"online intermediaries" like Uber.¹⁷⁰ This increase is greater than the total increase in employment since 2005, indicating that there has been a small net decline in traditional employment as well. A weak labour market contributes to the change, but Katz & Krueger believe that technology has enabled this change away from long-term employment to contingent "nonemployees" who are more vulnerable to firing in a downturn and lack the other job benefits of full-time employment.¹⁷¹

In summary, cognitive capitalism is an ongoing attempt to create a capitalist regime of accumulation using the immaterial knowledge economy as a source of economic growth, a process that has not yet stabilized due to internal contradictions between the demands of an immaterial economy and the effort to protect and preserve the cultural and institutional regimes of industrial capitalism. Economic value in the cognitive capitalist economy is subjectively measured by sentiment and control of knowledge production and access, while productive effort is distributed widely across society and through the lives of individuals in a way that makes it hard to assess individual labour value. At the same time, the rewards from collective effort are still distributed on an individual basis through a wage system based on that of industrial capitalism, with little relevance to the modern nature of employment. Companies exploit new technological advances for their own gain, while employees are trapped in older employment categories such as self-employment that do not reflect the new nature of work. These structures will inform what forces will operate on automation if

¹⁷⁰ Neil Irwin, "With 'Gigs' Instead of Jobs, Workers Bear New Burdens," *New York Times*, March 31, 2016, accessed April 3, 2016, <http://www.nytimes.com/2016/03/31/upshot/contractors-and-temps-accounted-for-all-of-the-growth-in-employment-in-the-last-decade.html?ref=business>

¹⁷¹ Ibid.

introduced in the current economic environment, the main issue being automation's relation to work.

Automation's relationship to work is not a new one, as Marx argues the introduction of mass technology to large-scale industry is responsible for changing the economic focus of physical production from the direct workforce to the General Intellect, as improving technology's productivity depends on the general improvement of science and the diffusion of that knowledge through society. As Cognitive Capitalism shows, adapting to this transition has had some implications for work and people's relationship to it. The need to fully engage people's living selves in employment, rather than just their working time, has resulted in work becoming more important for day to day living, alternative income sources being weakened, and this combined with the difficulty of measuring labour's contribution to immaterial production means that employment has become more precarious. This brings us back to the main issue of this project: will the introduction of a new stage of automation extending beyond physical production into cognitive fields liberate people from this form of control by reducing the need for work? Or as when the cognitive transition was started by the reduction of necessary work, will further automation only make work more precarious and increase people's dependence on it? To answer these questions, the next chapter will examine the two trends together, both of automation intended to reduce necessary labour and the pressures that form the constraint to work for individuals.

3. Automation And Work in the Cognitive Capitalist Economy

Understanding the nature and the place of work in the cognitive capitalist economy is critical because both the technological optimists and Luddites focus on the social consequences of applying automation technology to work. For this chapter, the aim will be to apply the theoretical conception of work in cognitive capitalism to the automation technology discussed in the first chapter, and this will proceed in two stages. First of all, the qualities of new automation technology, their potential application, and the scale of their impact will be examined along traditional and recent theoretical conceptions of technological unemployment. This section will highlight how cognitive automation differs from traditional automation given the theoretical background of cognitive capitalism. The second half of the chapter will focus on the capitalism side of cognitive capitalism, namely the mechanisms that maintain the constraint to work and influence the actions of individuals to commit their lives more fully to their work, such as the creation of workplace culture and engagement, technological means of management, and the wage relationship itself as a coercive mechanism inducing people into employment. By examining and then comparing these two trends, the goal of this chapter will be to identify a contradiction between these two issues from the point of view of individuals, and identify this contradiction as the source of the fear of automation, such as that expressed by the Luddite movement.

The nature of the new automation technology is important, and this is partially explained by Marx and Cognitive Capitalism. The automation of the industrial era and

the automation of the past few decades has been primarily suited for routine physical work, playing a similar role to the mechanization discussed by Marx. This is why, for instance, industrial robots have been most successful at routine tasks in manufacturing, as assembly line jobs are some of the most repetitive physical jobs on the market.¹⁷² Existing industrial automation technology depends on pre-programmed routine, where tasks are carefully designed in advance to be repeatable, and deviation from the standard can interrupt the process. This type of automation lacks perception and adaptive ability, being either blind or capable of limited visual perception in carefully controlled conditions.¹⁷³ Work for people in industrial occupations remained by filling in between machine operations on the assembly line.¹⁷⁴ Although the computerized automation technology is new, the concept of machines taking over physical roles while humans filled in the gaps of the process is not new, as Marx describes much the same situation in industrial mechanization, where automation supersedes the direct labour that constructed it, reducing workers to "conscious linkages" between the mechanical and intellectual organs of the machine.¹⁷⁵ What has changed with the first appearance of basic learning A.I. is that machines can now extend even further into the labour process, and separate technology from human labour even further.

Recent hardware and software advances such as those listed in the first chapter could change automation's relationship to the economy and to the labour market. New hardware advances provide new perception abilities for robots so that more fluid tasks

¹⁷² Frey & Osborne, *The Future of Employment*, 20

¹⁷³ Ford, *Rise of the Robots*, 3

¹⁷⁴ *Ibid.*, 3

¹⁷⁵ Marx, *Grundrisse*, Notebook VII, 692

and problem solving tasks can now be automated, while Deep Learning and evolutionary robotics mean that software can adapt to change and work in more unstructured environments than before. Computers can now do many tasks previously thought impossible, and many of these new capabilities include knowledge and cognitive work.¹⁷⁶ Even some of the roles for humans in traditional automation and mechanization left between sequences, and the social and knowledge work that supported it, may be increasingly susceptible to automation.

The first step is to determine how susceptible this knowledge work could be, and what susceptibility to automation means theoretically to an economy as a whole. This also involves understanding theories of technological unemployment, and what it means to an occupation or industry and the people employed in them to substitute technology for human labour.

Technological Unemployment In Practice and Theory

The 47% occupation loss from the Frey & Osborne study has been referenced before, but what sort of jobs are included in this figure and how many jobs could machines replace? As mentioned, many are routine tasks, and new cognitive automation allows some knowledge work to be outsourced beyond the company and paid work environment as well.

One study by the McKinsey Global Institute predicts that automation could drive additional productivity equivalent to 75 to 90 million full-time knowledge workers in

¹⁷⁶ McKinsey Global Institute, *Disruptive Technologies: Advances That Will Transform Life, Business, and the Global Economy*, May 2013, 40

developed countries and a further 30 to 55 million workers in developing countries.¹⁷⁷ Frey & Osborne estimate a similar number of 140 million knowledge workers affected worldwide.¹⁷⁸ Among the jobs affected are tasks that involve answering questions or carrying out tasks for other people. New cognitive automation and speech recognition from systems such as SmartAction, an advanced voice-recognition system used for customer service, mean that call centres, administrative support staff, and customer service could be automated.¹⁷⁹ Watson has already been applied to healthcare, and deep learning software has also proven capable at management, professional sectors like law offices for document discovery, and banking for fraud detection and financial services. A.I. has even shown capability at routine creative tasks, such as Narrative Science's program Quill which can write entire news articles on routine subjects such as sports and business that are readable and grammatically correct, or a Google patent for a system that automatically generates routine email and social media responses using an individual person's writing style and tone.¹⁸⁰

The ten occupations in the United States most susceptible to automation, according to Frey & Osborne, are: Telemarketers, Title Examiners (abstracters and searchers), Sewers (hand), Mathematical Technicians, Insurance Underwriters, Watch Repairers, Cargo and Freight Agents, Tax Preparers, Photographic Process Workers, and New Account Clerks. These occupations in 2014 totalled 492,500 jobs in the United

¹⁷⁷ Ibid., 44

¹⁷⁸ Frey & Osborne, *The Future of Employment*, 38

¹⁷⁹ McKinsey Global Institute, *Disruptive Technologies*, 44-45

¹⁸⁰ Ford, *Rise of the Robots*, 84-85, 93

States.¹⁸¹ The most susceptible industries as a whole consist of transportation, logistics, and the bulk of office and administrative support workers. Sales, services, and construction also show high probabilities. These occupations already show these trends using existing technology, while engineering bottlenecks are delaying the automation of tasks involving manual dexterity and social intelligence.¹⁸² This could mean some differing impacts depending on the sector of the service economy. Occupations and industries involving these sorts of tasks are most likely to be found in sectors such as personal services, areas of healthcare like psychology and counselling, and perhaps trades requiring dexterity such as electricians and plumbing.

Globalization is a competing explanation for the wage stagnation of the last decade, but there is evidence that manufacturing overseas is also undergoing automation. Output from Chinese factories since 1996 has soared 70%, while manufacturing employment has fallen by 25% over the same period, an equivalent to around thirty million workers. Foxconn, the Chinese company responsible for constructing iPhones, has also committed to aggressive automation to replace hundreds of thousands of workers.¹⁸³

The outcome of this level of unemployment could harm growth in a consumer-driven economy. Martin Ford argues that this type of job loss could prove damaging if consumer spending is not treated as a renewable resource, remembering that worker income is consumer income, and supplementing consumer income maintains demand

¹⁸¹ Bureau of Labour Statistics, "May 2014 National Occupational Employment Statistics And Wage Estimates United States," *Occupational Employment Statistics*, accessed February 11, 2016, http://www.bls.gov/oes/current/oes_nat.htm

¹⁸² Frey & Osborne, *The Future of Employment*, 38

¹⁸³ Brynjolfsson & McAfee, *Second Machine Age*, 184

and therefore overall economic activity. Paul Krugman explains that an inability to maintain effective demand is why recessions are economically damaging, because the temporary decline in consumer demand results in lower economic activity, as "your spending is my income, and my spending is your income."¹⁸⁴ Marx makes a similar argument in that production only achieves its last finish in consumption, and that as "without production, no consumption, but also, without consumption, no production."¹⁸⁵ Viewed in this context, humans with income can drive economic growth by converting income into spending which supports more income, so substituting human labour with technology that has no income and cannot spend can be seen as harmful to economic growth in practice. Going by Krugman's explanation of a recession as a period of low consumer demand, automation is like setting the foundation of a structural, permanent recession. But this is just a potential economic consequence if these job loss numbers are accurate. How does technological unemployment unfold, and could it actually take place?

The potential for technological advancement to lead to job loss is a contentious topic in theory. Economic theory asserts that to believe the idea of technological unemployment is to succumb to the "Luddite Fallacy," which holds that new technology results in new jobs to replace whatever jobs are lost.¹⁸⁶ Aside from 200 years of technological change, the Luddite Fallacy rejects technological unemployment as impossible because of elastic demand for goods. Economists at the National Academy of Sciences argue that when a good in the economy becomes less expensive, it frees up

¹⁸⁴ Paul Krugman, *End This Depression Now!* (New York: W. W. Norton , 2012), 28

¹⁸⁵ Marx, *The Grundrisse*, Introduction, 91

¹⁸⁶ Brynolfsson & McAfee, *Second Machine Age*, 176

money to be spent elsewhere which drives up labour demand in those other areas, meaning technological unemployment caused by rising productivity is impossible.¹⁸⁷ This assumes that human desires are infinite and that demand will always be elastic, however Keynes instead argues that in a future of abundance wealth accumulation will be "no longer of high social importance."¹⁸⁸

The second argument for the possibility of technological unemployment has to do with the rapidity of change. This argument relates to the time needed to adapt from one occupation to another should one become unemployed. If education involves multiple years of study, those could be years of unemployment.¹⁸⁹ Chapter 1 discussed Moore's Law, and how hardware and software capability doubled every 18 months. It is possible that the rate of technological change outraces the ability of people to adapt to the change, as people find themselves unable to educate themselves fast enough.¹⁹⁰ Until technological progress slows, this could be also a source of technological unemployment even if new jobs are created.

The final argument for technological unemployment concerns long-term, permanent unemployment. If technology develops in a certain way, it could erase the demand for certain skills at the wages that people are willing to accept, so that due to technology some skills would not be in demand even when offered at zero-cost.¹⁹¹ The consequence of labour substitution without a similar amount of new jobs created also

¹⁸⁷ Ibid., 177-178

¹⁸⁸ Keynes, "Economic Possibilities For Our Grandchildren," 369-370

¹⁸⁹ Brynjolfsson & McAfee, *Second Machine Age*, 178

¹⁹⁰ Ibid., 178

¹⁹¹ Ibid., 179

extends beyond the jobs immediately replaced, as the surplus labour of the newly-replaced jobs switches to pursue remaining jobs, driving down the wages of jobs not susceptible to automation.¹⁹²

Marx considers the drive towards using technology to replace direct labour as a natural tendency of capitalism, and describes the process in his discussion of mechanization. Marx first discusses how a specific form of fixed capital is transformed in the process of labour into a system of machinery, the most perfect form of which is the automatic system of machinery as "self-activating objective labour."¹⁹³ Rather than an instrument or tool which the worker projects their skills and knowledge through, the automatic machine "possesses skill and strength in place of the worker, with a soul of its own in the mechanical laws acting through it," and the production process becomes governed by general scientific process rather than labour.¹⁹⁴ The consequence of this when applied across industries and among competing companies is the greatest possible reduction in necessary labour, the realization of the natural tendency of capital to increase productivity. In comparison to machinery, the value-creation ability of individual labour becomes an "infinitesimal, vanishing magnitude."¹⁹⁵

This reduction in productive labour does not mean that humans become superfluous to the economy however, as Marx argued that relationship between humans and the production process would change as a result of mechanization but that humans would still have an important role to play:

¹⁹² Ibid., 181

¹⁹³ Marx, *Grundrisse*, Notebook VII, 694

¹⁹⁴ Ibid., Notebook VII, 693

¹⁹⁵ Ibid., Notebook VII, 694

He steps to the side of the production process instead of being its chief actor. In this transformation, it is neither the direct human labour he himself performs, nor the time during which he works, but rather the appropriation of his own general productive power, his understanding of nature and his mastery over it by virtue of his presence as a social body - it is, in a word, the development of the social individual which appears as the great foundation-stone of production and of wealth.¹⁹⁶

As covered in the previous chapter, Marx considers this new relationship where humans contribute to the industrial process through the General Intellect rather than direct labour to be antithetical to the value system of capitalism based on "the theft of alien labour time"¹⁹⁷ but Cognitive Capitalism illustrates how the economy instead adapted to the falling profits of material industry. Rather than collapsing as the social knowledge of society superseded direct individual labour as the source of wealth, capitalism adopted the immaterial wealth-creation potential of the General Intellect as a new foundation through commercialization, commodification and extending work and the wage-relationship into the cognitive sphere, with all of the contradictions described in Chapter 2. The automation of industry challenged the empirical measurement of individual work and wages as Marx described, but the adaptations of Cognitive Capitalism supported by the culture and ideology of the work-based society have managed to preserve the form of capitalism around individual labour.

Adding digital computers and cognitive automation could renew the automation process as Marx described, substituting direct labour in the immaterial sphere where work was resistant to older technology. Marx only wrote of automation in the

¹⁹⁶ Ibid., Notebook VII, 705

¹⁹⁷ Marx, *Grundrisse*, Notebook VII, 705

manufacturing and productive process, and was not incorrect that manufacturing would no longer lead the economy in wealth production as a result. The subsequent appearance of computers, software, and basic A.I. at the turn of the century could allow automation to expand beyond physical production and compete with cognitive workers on similar terms. As Marx writes, "...the greatest possible negation of necessary labour is the necessary tendency of capital [...]. The transformation of the means of labour into machinery is the realization of this tendency."¹⁹⁸ Once the technological barriers are solved, the tendency could theoretically reassert itself.

Going forward, cognitive automation is a technological development that has the potential to pose the same challenges to Cognitive Capitalism that the mechanization Marx describes posed to industrial capitalism. Capitalism survived that challenge by expanding the employment relationship into new areas that were not easily mechanized due to their use of human intellect and invention power that machines could not replicate, but was forced to endure instabilities and contradictions as a result. Now that the technological means of competing with humans cognitively are coming into being, this necessary tendency may reassert itself and once more challenge the organization of society around necessary labour, in a way that may require a similar foundational change and adaptation.

¹⁹⁸ Marx, *Grundrisse*, Notebook VII, 693

Cognitive Automation And The Accumulation Regime of Cognitive Capitalism

Cognitive Capitalism, by incorporating the regime of accumulation of capitalism, retains profit as the central goal of its leading participants. Vercellone writes that in Cognitive Capitalism the source of profit is the accumulation of surplus value produced by the social cooperation of the workforce.¹⁹⁹ The cognitive production process involves two steps: living labour employed under the wage relationship using their knowledge to deliver goods which can then be captured and valorized by their employers, with the resulting profit becoming increasingly indistinguishable from rent.²⁰⁰ If A.I. and computerization is to reduce necessary labour, it may integrate with the process of cognitive work and displace workers from this process similar to how fixed capital became machinery to displace workers from the process of material production. Cognitive automation could do this in two ways: by becoming a vehicle for experiential knowledge through machine learning and obscuring the relationship between people and their knowledge goods.

Knowledge work, subject to the wage relationship, is necessary for the process of accumulation, and it depends on the application and relation of different forms of knowledge. Formal knowledge is codified, objective knowledge that is external to people and easily accessible. Experiential or tacit knowledge is subjective, internalized knowledge found within people, things like intuition, habit, and personal experience. Intelligence is judgment, open-mindedness, and the capacity to assimilate new

¹⁹⁹ Vercellone, "The Becoming Rent of Profit?" 266

²⁰⁰ Ibid., 273

experiential knowledge and combine it with formal knowledge.²⁰¹ Formal knowledge has always been involved in industrial production, but cognitive work depends on the tacit and experiential knowledge embodied in the workforce accessed by subjectivity and people "giving themselves" to their tasks.²⁰² This is also an important distinction for intellectual property rights, as generally intellectual property rights exclude intellectual concepts, mental processes, and basic laws of nature, mainly due to an understanding that protecting these categories will slow technological progress and restrict innovation. Intellectual property is only meant to protect "a *particular* implementation, expression, or representation of an idea."²⁰³

One way that companies in the cognitive economy could use A.I. to reduce necessary labour is that under the right circumstances an A.I. may be able to serve as a means of harnessing the experiential knowledge of the General Intellect without needing to employ as many workers. A.I. can be embedded in the existing networks that people use everyday. This not only includes social media, but finance and online shopping, any networks over which people engage in social activity like Apple iTunes, Amazon, and Priceline.²⁰⁴ While programs in these networks can collect and process vast amounts of personal and behavioural information for their owners to profit from, they also move the costs of producing that information "off the books," or making it so that the company radiates risk and costs to other companies and individuals, whether

²⁰¹ Gorz, *The Immaterial*, 5

²⁰² Ibid., 8

²⁰³ The White House, *Economic Report of the President*, 215

²⁰⁴ Lanier, *Who Owns The Future?*, 65, 70

suppliers or customers.²⁰⁵ These network can already generate valuable information without incurring costs to do so, but adding A.I. can allow the subtle patterns and variations to be turned into programs that can complete tasks and gain experience using this data as a training set. The relationship between translation algorithms and language highlights how machine learning turns access to this data into experiential knowledge.

André Gorz writes that experiential knowledge becomes formal knowledge far more easily than the opposite path. Someone learning language by studying grammatical rules learns far more slowly than someone who is immersed in a language and internalizes the rules without them ever being formalized.²⁰⁶ This fact is what sets Google's translation software apart from other translation software: rather than translating the document directly using an internal ruleset of grammar and vocabulary, the algorithm conducts a search through its database of existing translated works for the best approximation of meaning. When entered into a 2005 competition against software designed by programming and linguistics experts to apply grammatical rules to direct computer translation, Google's approach was far more capable.²⁰⁷ The original training dataset used by Google was a large collection of multilingual UN and European Union documents, and Google has been adding to this database ever since.²⁰⁸ This gives Google's translation matrix an ability to develop a kind of experiential knowledge which can then be deployed anywhere with an internet connection. As mentioned in the first

²⁰⁵ Ibid., 62

²⁰⁶ Gorz, *The Immaterial*, 42

²⁰⁷ Ford, *Rise of the Robots*, 90

²⁰⁸ Brynolfsson & McAfee, *Second Machine Age*, 64

chapter, the thought-patterns may not be identical to that of a human, but it forms a close enough simulation of experience to produce equivalent outcomes.

IBM has been one of the pioneers in this area, and its system, Watson, shows how widely this technology could be applied. Although Watson's natural language ability described in the first chapter was designed to play and win Jeopardy, IBM has been discovering and marketing concrete productive applications for Watson's abilities. IBM describes Watson as "a platform for cognitive business," that uses natural language processing and machine learning to "reveal insights from large amounts of unstructured data," which is important because unstructured data makes up the majority of data available digitally.²⁰⁹ Watson for Oncology uses its ability to understand unstructured data to read handwritten patient records and identify evidence-based treatment options by combining the data with over 12 million pages of external research in textbooks and medical journals.²¹⁰ Not only is Watson more thorough than human physicians with its repository of research, but it is not limited by location the way a human is. IBM migrated Watson to the cloud in November 2013, and having the software accessible by anyone with an internet connection means Watson is available anywhere around the world at any time.²¹¹

Not only does this mean A.I. can compete with human workers, but A.I. programs might act as a way of embodying experiential knowledge as an immaterial good rather than as human capital. Intellectual property is designed to protect particular

²⁰⁹ "IBM Watson: What Is Watson?" Accessed January 28, 2016, <http://www.ibm.com/smarterplanet/us/en/ibmwatson/what-is-watson.html>

²¹⁰ "IBM Watson for Oncology," Accessed January 28, 2016, <http://www.ibm.com/smarterplanet/us/en/ibmwatson/watson-oncology.html>

²¹¹ Ford, *Rise of the Robots*, 104

implementations of ideas rather than mental processes, but when it comes to the processes embodied in A.I. that autonomously complete tasks, the distinction could be more difficult to make. Watson and Google Translate both work to immerse themselves in vast amounts of information to learn skills and abilities to accomplish tasks simulating human capital, but unlike human capital are products that can be licensed and sold. This is IBM's approach to Watson, selling access to the "Watson Ecosystem" which offers Watson APIs and access to IBM's system for registered partners.²¹² This means that IBM does not sell Watson, but offers access to the technology through partnerships and licenses, following the pattern of how intellectual property rights are used to valorize immaterial goods by focusing on access as a means of extracting rent. A.I. like Watson is offered as a more efficient and effective substitute for human capital, redirecting costs for other companies that would normally go towards worker's wages towards the A.I. owner company's profit as rent.

All this initially seems to leave people with a declining economic role in production. However, while cognitive automation may be more autonomous than mechanization, like in industrial automation human activity is a necessary precondition for its creation and development. Marx describes the creation of machinery as the appropriation of human labour power and the physical embodiment of human scientific achievement, such that a machines' effectiveness is "out of all proportion to the direct labour time spent on their production."²¹³ While this occurs, Marx sees the role of humans changing to one outside the productive process but integral to it, where

²¹² "IBM Watson for Oncology"

²¹³ Marx, *Grundrisse*, Notebook VII, 693

humans "social individuals" further develop the scientific and social knowledge which guide the production process.²¹⁴ A.I. can be viewed the same way: although A.I. reduces the amount of recognized necessary labour the experiential knowledge that is embodied and licensed within these cognitive computing programs ultimately originates from the scientific and social activity of people. Google's translation matrix does not contain the formalized rules of the language, only examples of translations completed by native speakers which it averages out to produce the results, while Watson Oncology accesses medical journals written by human experts. Cognitive systems may allow for faster, broader access and more effective utilization than a human can accomplish, but the humans responsible for those initial documents that made A.I. learning possible are ignored economically in the process, being "one step removed from the world of employment and compensation," the focus instead being on the algorithm.²¹⁵ The human creators bear the costs of the service which the owner of the A.I. profits from as a positive externality. Note that this automation is similar to the actions of other companies described in Cognitive Capitalism, who offshore the more risky and costly manufacturing sectors of their business to contractors and focus on value-added immaterial work. Businesses utilizing server-based A.I. take this one step further, and can outsource some cognitive labour outside the company and even out of the paid work environment. Automation is not completely autonomous, as people are the ultimate source of information and value, but A.I. can be used to obscure this relation. As Jaron Lanier writes, "digital information is just people in disguise."²¹⁶

²¹⁴ Ibid., Notebook VII, 705

²¹⁵ Lanier, *Who Owns The Future?* 20

²¹⁶ Ibid., 19

This reduction in work is at the root of the fear of automation rather than automation itself. The Luddites smashed the weaving machines to protect their place in the economy out of fear of being displaced. Cognitive computing and A.I. continues the automation of labour, overcoming the technical barriers that prevented it from advancing beyond the material sector and revisiting a contradiction of capitalism that Marx wrote of in 1857: "[Capital] presses to reduce labour time to a minimum, while it posits labour time, on the other side, as the sole measure and source of wealth."²¹⁷ While the economy introduces labour-saving technology and reduces the amount of productive work needed by society, paradoxically it increases the need people have in society for work. Cognitive capitalism, stripped of the direct labour management allowed in Fordism but attempting to protect the existing structure of capitalism and fully engage workers intellectually, is strengthening the coercion mechanisms of culture and the wage-relationship to maintain the importance of employment.

Work as the Ideological and Cultural Center of Capitalist Society

The reason that automation under cognitive capitalism will be a destructive force in many people's lives if it produces job losses such as those forecasted by Frey & Osborne is because Cognitive Capitalism preserves and enhance the mechanisms from industrial capitalism that place work at the center of social life. At the same time that cognitive automation stands to reduce the number of jobs available, jobs are the primary source of income, civic participation, and individual dignity.

²¹⁷ Marx, *Grundrisse*, Notebook VII, 706

As seen in Chapter 2, the nature of work under Cognitive Capitalism is changing towards a collective structure that depends more on process than output. In switching the focus of the economy to knowledge work, the traditional measurements of productivity as output per time unit are no longer applicable. At the same time, remuneration is still provided through the wage relationship, which focuses on individual time-delineated labour and preserves the job structures of industrial capitalism despite the contradictions in applying a material labour system to immaterial labour. The ideology and wage-relationship pressuring people towards work are strengthened under Cognitive Capitalism to provide an indirect coercion mechanism to replace the loss of direct Taylorist management.²¹⁸ As a result the role of the economy in the current discourse is to provide jobs and enable people to work, rather than jobs existing as a way to contribute to the economy.²¹⁹ Why is there such a pressure to preserve work under the wage relationship if it is not suited to the immaterial work required by the cognitive economy?

In the industrial economy, work was seen as a necessity, not a luxury. Keynes considers the "economic problem," the struggle for subsistence, as a necessity of not only humans but of all biological life. For that reason, Keynes sees all of humanities' instincts and impulses having evolved to address the goal of combating scarcity, as it was an ever-present challenge to be overcome. He predicts a future where the economic problem of humanity is solved through scientific progress, though because of the long history of work he fears a transition period where the public would suffer what he calls a

²¹⁸ Vercellone, "The Becoming Rent of Profit?" 273

²¹⁹ Gorz, *Reclaiming Work*, 56-57

"general nervous breakdown" when faced with the challenge of how to occupy leisure time when freed from "the spur of economic necessity," and forced to discard "the habits and instincts of the ordinary man bred into him for generations."²²⁰

Similarly, John Stuart Mill writes:

"I must confess I am not charmed with the ideal of life held out by those who think that the normal state of human beings is that of struggling to get on; that the trampling, crushing, elbowing, and treading on each other's heels, which form the existing type of social life, are the most desirable lot of human kind, or anything but the disagreeable symptoms of one of the phases of industrial progress."²²¹

Like Keynes, Mill sees work and competition as an unfortunate necessity of life. Scarcity demands a struggle to survive, and work forms part of the struggle. What Mill objects to is the attempt to portray it as "social perfection," a standard of living to be preserved at all costs and at the expense of competing modes of existence."²²² Mill prefers a reality where no one is poor but no one desires to be richer, living without fear of being thrust back into poverty.

In the transition from the industrial age of Mill and Keynes to the cognitive economy of the present, the worst fears of Keynes and Mill have been realized. Automation may significantly contribute to solving what Keynes calls the economic problem of humanity, but it is only a continuation of the growing productivity that has already contributed to the crisis of Fordism, and automation also stands to further hurt

²²⁰ Keynes, "Economic Possibilities for Our Grandchildren," 366-367

²²¹ John Stuart Mill, *Principles of Political Economy with some of their Applications to Social Philosophy*, William J. Ashley, ed. 1909. Library of Economics and Liberty. IV.6.5 Accessed January 29 2016. <<http://www.econlib.org/library/Mill/mlP61.html>>.

²²² Mill, *Principles of Political Economy with some of their Applications to Social Philosophy*, IV.6.5

incomes already depreciated by the constitutional crisis of work. At the same time the transition to a cognitive economy has not changed the attitudes towards work or the place of work in peoples' lives, and if anything has intensified the drive towards paid individual employment, such that it now is consuming life beyond the workplace. The very "social perfection" that Mill objected to is the view that has become normalized.

Keynes predicted that technology would liberate people from the necessity of work by increasing people's productivity so that they could achieve the same amount of work in less time. To a certain extent, his prediction has been accurate: recorded productivity has risen across many developed countries. OECD statistics for Unit Labour Costs indexed to 2010 show productivity in Europe, the United States, and Japan rising consistently over the long term, save for the impact of the 2008 crash (see Figure 3-1).²²³ Where Keynes' prediction goes astray is that the productivity of work has become decoupled from wages due to the crisis of value of cognitive labour and its product described in Chapter 2. Consider US productivity and real full-time earnings of wage and salary workers over 16 indexed to 2007: wages stay mostly flat while productivity increases (see figure 3-2). Without the connection between productivity and wages, the liberation Keynes anticipated cannot occur from technology-driven productivity. On the contrary, despite increasing productivity and stagnant wages, work intensity has been going up by a large amount. Even though recorded work hours per individual are falling in many countries such as France and the U.K., the reported amount of work effort in terms of work speed and tension has risen, as has the total

²²³ OECD, "Main Economic Indicators - complete database", Main Economic Indicators (database), <http://dx.doi.org/10.1787/data-00052-en> (Accessed on January 27, 2016) Copyright, 2014, OECD. Reprinted with permission.

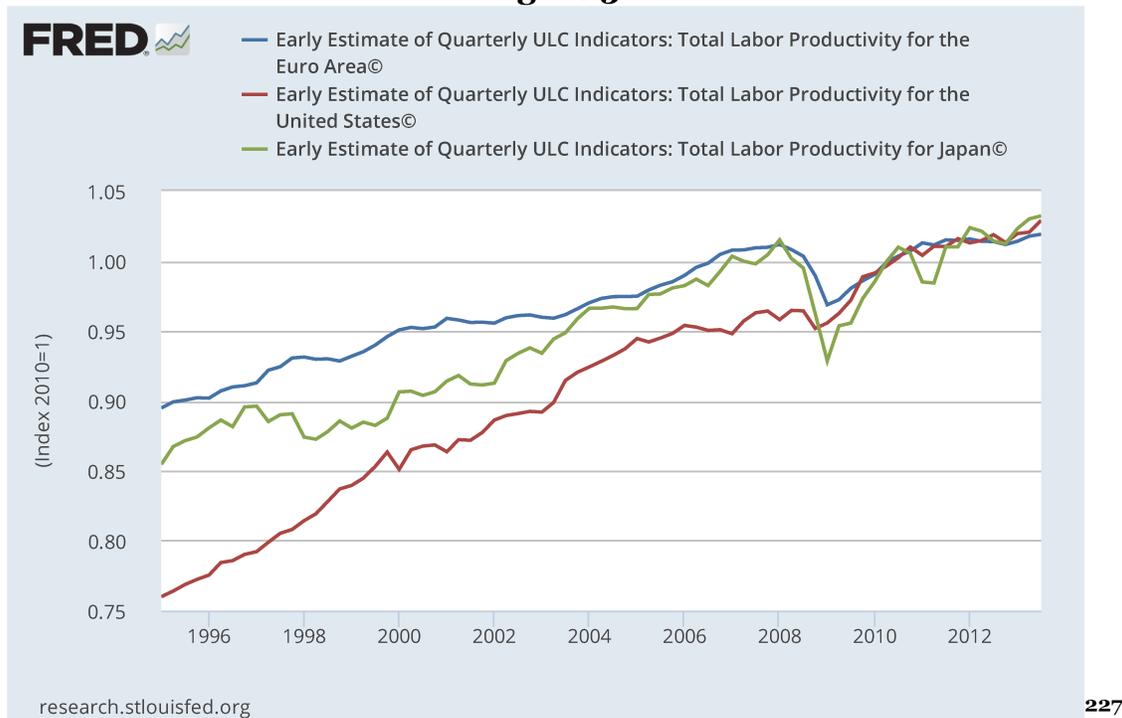
work hours commitment per household.²²⁴ The United States is an exception in that work hours never fell, remaining at or surpassing highs set in the 1970s. For instance, married couples in the United States increased their joint working time from fifty-three hours per week to sixty-three hours per week between 1970 and 1998, and many American workers are forced to take on more than one job given that almost a quarter of American workers were earning less than \$8.70 by 2001.²²⁵ In Britain and the United States, real wages also fell for those at the bottom due to institutional choices like reducing or abolishing the minimum wage.²²⁶ Despite productivity growth, work is taking up more and more time in people's lives, in some cases to make up for the loss of real wages.

²²⁴ Francis Green, *Demanding Work* (Princeton, New Jersey: Princeton University Press, 2006), 174-175

²²⁵ *Ibid.*, 124, 174-175

²²⁶ *Ibid.*, 122

Figure 3-1



Culture and ideology play a role in keeping work at the center of social life by making employment a major contributor to personal identity and attaching significant social stigma to unemployment. Under cognitive capitalism the worker is also the embodiment of value as living labour, which incentivizes companies to find ways for their employees to devote themselves and their experience more fully towards their work. For employees this means employment has become about more than just the struggle for subsistence, and culture has made a moral argument that employment is virtuous. The corollary is that unemployment is a sign of personal failure.

Employees in existing jobs are subject to social pressures to keep them in those jobs and devote more of themselves to their work. In the United States, the popular

²²⁷ OECD, "Main Economic Indicators - complete database"

employer approach to labour in the Fordist era stemmed from Taylorism or "scientific management," which embodied assumptions that workers were lazy and rebellious, with no intrinsic dedication to the job.²²⁸ Japanese factory culture considered dominance of the workforce to be a waste of resources, and that it was better to engage and encourage worker initiative, allowing factories to "increase productivity without increasing production." The Japanese contribution of *kaizen*, or flexible production based on worker engagement and contribution, allowed the development of spontaneous and flexible "productive cooperation" in the workforce.²²⁹ This has the benefit of raising productivity while also building loyalty in the worker towards the company.

Technology may make putting work at the center of a person's life and identity possible such as through mobile workplace email, but a culture developed through subtle conditioning and internalized within the employees also drives it.²³⁰ One example of internalized culture is "presence bleed." This is the process where boundaries between office life and home life break down, where the work-life balance blends into work as people feel a responsibility to be constantly online and available to do tasks outside of their paid hours, often resulting in employers providing more work they see employees as newly capable of completing.²³¹ Some employees actively embrace this and attribute it to a sense of fulfillment and satisfaction that working gives them, while some employees do this to reduce the workload they face during the working day. There is

²²⁸ Gorz, *Reclaiming Work*, 29

²²⁹ Ibid., 30

²³⁰ Fumagalli & Morini, "Life Put To Work," 237

²³¹ Melissa Gregg, *Work's Intimacy* (Cambridge, U.K.: Polity Press, 2011), 2

also a need to appear competent to co-workers and clients, to affirm one's value to the their workplace.²³² Loyalty is a large part of modern employee culture as well, but the new decentralized nature of workplace organization means that loyalty is not due to the boss or employer but to the team, the co-workers that form the network of the new collective workplace. Employers actively nurture this culture by sponsoring team-building exercises, corporate retreats, and company "culture" officers to bond workers together and simulate a democratic workplace to heighten employee buy-in. Employees are then drawn into increasing their workload and being always-on to avoid letting down the "team" with which they have intimately bonded.²³³ These subtle cultural forces allow more and more of life to be defined by employment without needing to use pay as incentive.

This cultural focus on blurring the work-life balance does not always run both ways. While employees are now expected to bring work home, and many internalize a responsibility to do so independently, companies strive to ensure employees keep on task and do not bring life into the workplace. In this way, employers still embody the distrust of employees found in the hierarchical structures of Taylorism, but rather than expressing it through the strict managerial controls of the Fordist factory companies are turning to technology to ensure every employee is maximizing their work time. Computer technology and internet access are critical to the cognitive workplace, but along with their increased use has come increased employee surveillance. This includes normal software whose capabilities are extended, such as anti-virus software designed

²³² Gregg, *Work's Intimacy*, 3

²³³ *Ibid.*, 74-75

to scan emails that are sent and received and firewalls reinforced to block not only malicious code but internet content judged "inappropriate" by management.²³⁴ More specialized technology includes keystroke and mouse click tracking, remotely captured screenshots to monitor communication, storing copies of email messages where employees cannot access them, logging every action such as opening a file or application, and remotely viewing the worker in real time.²³⁵ Companies defend this practice as the protection of intellectual property, which in cognitive capitalism is of central importance to business, and courts in the United States have tended to rule in favour of surveillance when used for business purposes.²³⁶ Of main concern is "cyberloafing," where computer time is used for non-work related purposes, and employees have been fired for this sort of behaviour, discovered through surveillance and tip lines for employees to report on one another.²³⁷ This is legal in the United States, as private-sector employees do not have any protection against searches or surveillance by their employers under the U.S. Constitution.²³⁸ The only common-law defence is that privacy exists where there is a reasonable expectation of privacy, and this is easily avoided by posting signage notifying employees of surveillance.²³⁹

This has largely been avoided in Europe, as employees are more likely to win privacy cases over less intrusive monitoring than in the US. Privacy laws are also

²³⁴ Lothar Determann & Robert Sprague, "Intrusive Monitoring," *Berkeley Technology Journal* (26:979, 2011), 981-982

²³⁵ *Ibid.*, 981-982

²³⁶ *Ibid.*, 1017

²³⁷ *Ibid.*, 983-984

²³⁸ *Ibid.*, 990

²³⁹ *Ibid.*, 1017

expressly enshrined in Article 7 and 8 of the Charter of Fundamental Rights of the European Union, which protect the communications of family and private life, as well as protection of personal data.²⁴⁰ This charter was specifically brought in to protect against the possibility that European Union supranational laws that removed economic and trade barriers could also supersede national law protecting privacy and result in a similar situation to the United States.²⁴¹ The culture in Europe has resulted in employees having more legal discretion and power in relation to the employer, and several employers have been reprimanded in France and Germany for monitoring communications and data mining.²⁴² This shows that while there is still motivation on the part of the employer to engage in these behaviours, in Europe the legal framework has sided with workers to a larger extent so that employees are afforded a level of protection that they lack in the United States.

Cultural forces also push the unemployed towards employment through stigmatization, due to the focus on personal responsibility for finding gainful employment. F. A. Hayek, described by Moulrier Boutang as the "heretical genius of the dominant orthodoxy,"²⁴³ writes that success depends on the individual applying their abilities properly, as "in a free society we are remunerated not for our skill but for using it rightly."²⁴⁴ Unemployment in this light could be seen as a failure of the individual to properly apply their abilities, as proper application would result in employment and

²⁴⁰ Determann & Sprague, "Intrusive Monitoring," 1019, 1023

²⁴¹ Ibid., 1022-1023

²⁴² Ibid., 1029, 1031

²⁴³ Moulrier Boutang, *Cognitive Capitalism*, 108

²⁴⁴ F.A. Hayek, *The Constitution Of Liberty* (Chicago: University of Chicago Press, 2011), 144-145

remuneration. Free society only provides opportunity to search for usefulness, which means the most important skill is "the skill of discovering the most effective use of one's gift."²⁴⁵

If employment is held to be a moral virtue to be pursued and established as central to a person's identity, then unemployment is a moral failing, and indication that a person lacks responsibility or skill. For a citizen who has internalized this line of thinking, they may feel the "poignant grief" that Hayek speaks of, feeling their talents as wasted and not being useful to society. Society reinforces this with the evolution of the welfare state into the "workfare" state, which treats the unemployed as "incompetents and scroungers," following Hayek's view of personal responsibility.²⁴⁶ In the classical view, more employment is always forthcoming if workers as a whole would accept lower wages.²⁴⁷ If the unemployed lack employment, it is because they lack the skills to find employment or they lack the will-power. The workfare state takes this ideology as a basis for policy, redesigning unemployment assistance to obligate the unemployed to perform menial work or social utility as a precondition for assistance.²⁴⁸

Even in the industrial era of capitalism the idea of the unemployed being at fault for their condition was challenged. Keynes argued against this on economic terms, stating that to limit unemployment to either frictional unemployment or voluntary unemployment is built on faulty assumptions, and that there are conditions of "involuntary unemployment" where workers want work but there are not enough jobs to

²⁴⁵ Ibid., 145

²⁴⁶ Gorz, *Reclaiming Work*, 81

²⁴⁷ Keynes, *The General Theory of Employment, Interest, And Money*, 8

²⁴⁸ Gorz, *Reclaiming Work*, 81

be had.²⁴⁹ Even Hayek, who supports the moral argument for work, opposes making the moral argument towards work as employment too strong because "not working to earn an income does not necessarily mean idleness."²⁵⁰

These cultural ideas have nonetheless survived into the modern economy, and if anything they have been strengthened in order to drive people towards work. The United States welfare reforms of 1996 under Bill Clinton were presaged by a revival of the industrial era morality arguments, shifting the blame from the lack of jobs in the economy to the lack of skills among the unemployed.²⁵¹ Work, in terms of earning an income, has gone from a symbol of responsibility to a part of one's identity, and from Hayek's conception as making oneself useful for society to a commodity that everyone must have, no matter what sacrifice is made to get it. As Gorz writes, "be prepared to make any and every concession [...] to get or keep a job, since those who lose their jobs lose everything."²⁵² Even a liberal thinker like Hayek does not go this far, as Hayek opposes a society where intellectual, moral, and cultural leaders need to be employees, and argues that such a society leads to a propertied class without intellectual leadership or a defensible philosophy of life. There is no reason "why an occupation that does not bring about a material return should not be regarded as honorable."²⁵³ Nevertheless, the capitalist ideology of the job as the center of life persists.

²⁴⁹ Keynes, *The General Theory of Employment, Interest, And Money*, 15

²⁵⁰ Hayek, *The Constitution Of Liberty*, 193

²⁵¹ Doug Henwood, *After The New Economy* (New York: The New Press, 2003), 107

²⁵² Gorz, *Reclaiming Work*, 56

²⁵³ Hayek, *The Constitution Of Liberty*, 193-194

Along with the culture of work that drives people towards employment, Cognitive Capitalism has retained the wage relationship of industrial capitalism as a coercive measure to drive desire for employment. If culture says that those who lose their job lose everything, the wage relationship enacts that threat, as those who lose access to income cannot survive in the modern urbanized economy. The challenge, as covered in Chapter 2, is that the rearrangement of labour around the immaterial dimension does not support the traditional wage system. Legal and institutional effort has gone into maintaining the system despite these challenges weakening it, to make sure that the threat of "losing everything" remains.

Income is necessary in the modern economy to survive, a process started in the transition from mercantile to industrial capitalism. Moulrier Boutang notes that part of the transition to industrial capitalism was the need to create a ready supply of labour for industry, and a process of commoditization of services and the collection of taxes in cash ensured that income became a prerequisite for participation in society.²⁵⁴ The new mandatory cash outflows create a pressure to earn cash, and combined with the enclosure movement and newer forms of farming meant that many landed peasants were forced into cities to work in the new factories for "the man with the money."²⁵⁵ In combination with the limitation of the owner's control to the process of work, this resulted in the establishment of the system of free wage labour.²⁵⁶

Part of the crisis of Fordism involved a weakening of the wage relationship, as new forms of income reduce its coercive power. Income such as pensions and

²⁵⁴ Moulrier Boutang, *Cognitive Capitalism*, 102

²⁵⁵ *Ibid.*, 102

²⁵⁶ Moulrier Boutang, *Cognitive Capitalism*, 102

unemployment benefits free up time outside of work, and this free time became a source of innovation and knowledge production.²⁵⁷ At the same time, workers subject to the wage relationship in the new knowledge sectors posed problems to the usual alienation of labour. For instance, it is more difficult to separate cognitive workers such as computer programmers from the outcome of their work than to separate the goods from a factory in which an employee works, as a computer programmer will feel more engaged with the product of their work.²⁵⁸ As a consequence, Microsoft turned to stock options as pay to reduce the turnover of dissatisfied employees, and the concept of profit-sharing has seen some implementation at large institutions.²⁵⁹ Despite this initial retreat from the wage system, there have been concerted efforts to preserve it. The Sarbanes-Oxley Act in the United States is one dedicated example, as it restricts the use of stock-options as a rival compensation scheme.²⁶⁰ Smaller start-up companies eschew the wage-relationship in their initial burst of innovation, but are "brought back into line" when they are bought up by larger established companies.²⁶¹

The importance placed on the wage relationship seems strange given the use of A.I. to replace paid workers. The dominant cultural view is that a work-based society is the only society that is possible and that "identity-given socialization through work" is all that stands before "despair of non-being."²⁶² And yet machinery is not applied where

²⁵⁷ Vercellone, "The Becoming Rent of Profit?" 265

²⁵⁸ Moulier Boutang, *Cognitive Capitalism*, 119

²⁵⁹ Ibid., 119

²⁶⁰ Ibid., 154

²⁶¹ Ibid., 154

²⁶² Gorz, *Reclaiming Work*, 58

labour is in short supply, but to reduce labour where jobs already exist: "Machinery enters only where labour capacity is on hand in masses."²⁶³ Perhaps, since A.I. is not seen as capable of replacing a majority of occupations yet, the incentive is to use A.I. to lower aggregate wages by keeping a large labour supply even as labour demand decreases, decreasing aggregate labour costs. Or the persistence of the wage relationship and the process of automation may be not yet be seen as related as companies unwittingly engage in a technological tragedy of the commons, where individual companies automate to realize profit growth but the collection of individual actions are contradictory to a collective desire to maintain the current system of wage-labour.

Looking at the dominant cultural views of work, and how companies and the state work to maintain the wage relationship, we can see that the centrality of wages and employment for most people is a result of culture and social decisions, rather than a natural evolution driven by external economic forces. The culture of work legitimizes the wage system, which in turn coerces people into adopting the culture. But even so, we have seen that the challenges of the cognitive economy are such that maintaining the capitalist mode of accumulation results in an unstable regime.

What all these forces go to show is that there is constant pressure creating a need for individuals to find and keep work, whether direct external coercion through workplace surveillance and the precarious wage relationship, or cultures and workplaces that maintain an internalized desire to commit fully to finding and engaging with work. Therefore from the perspective of the individual society is geared towards

²⁶³ Marx, *Grundrisse*, Notebook VII, 702

work as something that everyone must "have," and the harder employment is to get and keep, the more sacrifices and compromises and effort must be made to acquire it. And if work were to disappear, these pressures would not, resulting for individuals in more sacrifices and more hardship in the pursuit of work. André Gorz writes

"the unfettered power capital has assumed over labour, society, and everyone's live depends precisely on 'work' - not the work you do, but the work you are made to do - retaining its centrality in everyone's lives and minds, even when it has been to a massive extent eliminated, 'saved' and abolished across the whole of society [...]"²⁶⁴

Automation is labour-saving in that it can replace humans in certain jobs, so that people no longer need to do those jobs. But as Gorz indicates, saving people from needing to do one job or task is a different thing from liberating individuals from 'work' itself. Perhaps the individual need *to* work and the societal need *of* work are different, which makes the individual need to work instead become a constraint. If automation means the societal need to work is changing, then perhaps these pressures creating the individual constraint to work should change as well.

Automation and The Legitimacy of Capitalism

Automation, whether cognitive or industrial, cuts costs for companies while boosting production, resulting in short-term rewards for individual firms even if in the long run the overall rate of profit falls. Automation also does not solve the underlying instability of cognitive capitalism, and can be seen as related to the initial mechanization process Marx predicted would lead to the General Intellect as a direct

²⁶⁴ Gorz, *Reclaiming Work*, 53

force of production in the first place. As Cognitive Capitalism is already an unstable process, could too much further automation cause people to question the legitimacy of the capitalist foundation of labour time as the primary measure of wealth and income? The transition to Cognitive Capitalism shows that capitalism has already survived similar challenges to its underlying logic yet has responded and adapted in ways that resulted in its survival. Whether structurally or ideologically, capitalism could adapt and respond to the challenges automation posed to its legitimacy.

The underlying instability in Cognitive Capitalism comes from the need to support people in society and allow their free interaction to enable labour reproduction which conflicts with the accumulation regime of capitalism that drives the economy towards control of the workforce and of market in the search for profits. Existing capitalist systems are ineffective at recognizing collective cognitive labour: higher wages cut into profits, and higher government subsidies for wages are limited in effectiveness whenever a crisis such as the OPEC crisis in the 1970s hits or when unemployment rises.²⁶⁵ Automation reducing necessary work in an environment where wages are the only acceptable and sufficient form of income could therefore lead to reduced living standards, and an initial increase in profits for companies and savings for consumers could eventually lead to longer-term degradation in employment prospects.²⁶⁶ The danger of depressed incomes from mass unemployment is that it could drive further automation to lower costs leading to still more unemployment, starting a downward cycle of effective demand similar to recession. Automation technology can only produce,

²⁶⁵ Moulier Boutang, *Cognitive Capitalism*, 188

²⁶⁶ Lanier, *Who Owns The Future?*, 250

not consume, and if humans are the only consumers any system which cannot provide the means for humans to consume questions the validity of a system based on consumption and production. One way the legitimacy of the system could survive, though, is through the responsibility that is placed on the individual as an actor, and this is seen in the current political and social response to the threat of automation.

Rather than a systematic challenge to capitalism, automation is portrayed as individual competition, a rival worker competing for employment on the same terms as a person. Frey & Osborne write that "the 20th century has been a race between education and technology."²⁶⁷ Recent data, on the other hand, is beginning to show that education no longer guarantees skilled employment or protects from job loss, resulting in skilled workers displacing unskilled workers from unskilled service jobs.²⁶⁸ In a way, this means education still improves the chances of employment from an individual perspective, but in this case at the expense of another person, meaning the employment effect is still a net negative, and job quality declines for those who do find employment.

This difference between systematic and individual perception means higher education is still advanced as a means of staying ahead of automation on an individual basis, to "climb the skills ladder, somehow staying just ahead of the machines."²⁶⁹ On September 2, 1963, President John F. Kennedy said in an interview that to combat a situation with too many people coming into the labour market while "too many machines are throwing people out," he proposed programs focused on vocational

²⁶⁷ Frey & Osborne, *The Future of Employment*, 10

²⁶⁸ *Ibid.*, 13

²⁶⁹ Ford, *Rise of the Robots*, 249

education and job retraining.²⁷⁰ The Liberal Party of Canada's platform in the 2015 Canadian Federal Election, fifty-two years later, pledged \$775 million per year that would go towards job and skills training that will "help Canadians get the training they need to find and keep good jobs."²⁷¹ The McKinsey Institute suggests that automation could drive the creation of many new types of jobs "if businesses and government can innovate effectively and adjust education to focus on new skills."²⁷² The need for experience and education has even led to unpaid internships, jobs taken for no pay to build experiential knowledge in the hope of one day gaining paid work.²⁷³ The focus is on the individual, and the state as an actor exists to assist the individual in making sure training is accessible and affordable.

This is not to say that education is not an effective policy, but the difference is whether the responsibility lies with the individual or with the state and society. The Danish flexicurity system changes this relationship between the individual and the state, as it combines state-funded and state-organized education and job experience programs with generous unemployment support, assuming some of the risk and costs otherwise borne by the individual. The Blairist "workfare" approach reverses the responsibility and holds that if one is unemployed, it is because they did not manage their human capital well enough to sell their labour, and it is up to the individual to use their free time to improve themselves until they are once more in demand.²⁷⁴

²⁷⁰ Ibid., 249

²⁷¹ "Job and Skills Training," accessed February 12, 2016, <https://www.liberal.ca/realchange/job-and-skills-training%E2%80%A8%E2%80%A8/>

²⁷² McKinsey Global Institute, *Disruptive Technologies*, 49

²⁷³ Atkinson, *Inequality: What Can Be Done?* 135

²⁷⁴ Gorz, *The Immaterial*, 25

The other alternative is to create new jobs to address unmet human needs, but sometimes this too is meant to be accomplished by the individual, such as the focus on entrepreneurialism and viewing people as enterprises.²⁷⁵ As seen in Chapter 2, self-employment is on the rise (although this is partly driven by the rise in employment categorized as such to avoid certain regulations through technicalities). A BSR issue brief attributes automation, 3-D printing, and the sharing economy as drivers of self employment, bringing more people into the economy.²⁷⁶ If traditional employment is fading, it can be up to the individual to create their own opportunity. If the problem is approached in this way, the larger issue remains unaddressed, but the legitimacy of the system could survive.

A Matter of Perspective

The issue with automation and society is more complicated than finding ways to cope with advancing technological capability throwing people out of work. The fear of technological unemployment is bound up in implicit assumptions and contradictions that underline and structure the modern economy. It is assumed that sufficient income should only come from a job, and that leads to prioritizing the protection of employment when it is threatened. It is also assumed that having a job is a defining part of modern society, both economically and morally. The International Labour Office (ILO) writes that "for everybody, decent work is about securing human dignity."²⁷⁷

²⁷⁵ Ibid., 20

²⁷⁶ Jessica Davis Pluess, *Issue Brief: Good Jobs in the Age of Automation* (2015), 16, accessed February 12, 2016, <http://www.bsr.org/en/our-insights/report-view/inclusive-economy-brief-jobs-and-automation>

²⁷⁷ Green, *Demanding Work*, 20

Unemployment is stigmatized as an individual failure through incapacity or poor choices, even if due to wider structural causes. Automation in this context is "stealing" jobs, and denying people these advantages and full participation in society. Yet due to a natural tendency of capitalism to lower costs and reduce necessary labour time, automation continues regardless, leaving people trapped between the two forces.

Stephen Hawking discusses the social effects of this advance in technology by saying:

The outcome will depend on how things are distributed. Everyone can enjoy a life of luxurious leisure if the machine-produced wealth is shared, or most people can end up miserably poor if the machine-owners successfully lobby against wealth redistribution. So far, the trend seems to be toward the second option, with technology driving ever-increasing inequality.²⁷⁸

Can automation's promise of liberating individual from the constraint to work be achieved if the technology is approached differently? Jaron Lanier writes that the problem is not how many jobs might be lost to automation but "how many jobs might be lost to automation if we think about automation the wrong way?"²⁷⁹ Similarly, what if we think about work in the wrong way? Many necessary productive tasks are unrecognized by income, such as social reproduction of the workforce and the creativity, social engagement, and free development of individualities that make up the General Intellect. But not all jobs that are recognized are "decent" jobs either. As Hayek writes,

²⁷⁸ Stephen Hawking, "Science AMA Series, Stephen Hawking AMA Answers!" *Reddit*, October 8, 2015, accessed April 3, 2016, https://www.reddit.com/r/science/comments/3nyn5i/science_ama_series_stephen_hawking_ama_answers/

²⁷⁹ Lanier, *Who Owns The Future?*, 85

"not working to earn an income does not necessarily mean idleness."²⁸⁰ Concurrently, some jobs that *are* recognized are perceived as unproductive or unnecessary by those employed in them, situations that David Graeber calls "bullshit jobs" where jobs are created "for the sake of keeping us all working."²⁸¹ And if automation means the individual constraint to work is diverging from the societal need for work, then challenging the correlation between income, work, employment, and dignity could open up space to approach automation in a more positive way. The next chapter will focus on some policies and methods of approaching this.

²⁸⁰ Hayek, *The Constitution Of Liberty*, 193

²⁸¹ David Graeber, "On The Phenomenon of Bullshit Jobs," *STRIKE! Magazine*, August 17, 2013, accessed March 25, 2016, <http://strikemag.org/bullshit-jobs/>

4. Policies To Make Automation A Beneficial Process

In the previous chapter, automation technology is shown to evolve according to the natural tendency of capitalism to reduce necessary labour time and boost profits, which in the cognitive capitalist context is accomplished through creating monopoly positions, rentier mechanisms and obscuring human contributions to production. At the same time, opportunities for income, participation in society, and human dignity are bound up in employment, meaning as necessary work disappears people's access to these benefits disappears as well. This is the cause behind the fear of automation, where the majority of society is pushed towards employment which is at the same time is being taken away from them by new robotics and A.I. expanding the process of automation. To protect people from the effects of a loss of employment, various policies options exist to either prevent the jobs being lost in the first place or to protect people from the loss of job benefits that widespread work reduction would result in. Some of these policies are unsuited to dealing with the particular kind of unemployment that automation produces, but others have strengths and weaknesses in protecting people from hardship and maintaining a standard of living in today's society.

This chapter will look at three different policy strategies advanced to provide income and a stable standard of living for people in developed economies: guaranteed employment, flexicurity, and guaranteed income.

Create New Work Through State Activities: Guaranteed Employment

Facing a threat of involuntary unemployment, one policy suggestion is to make plans to guarantee that every citizen who wants a job can find and keep one, to ensure a sufficient income to support themselves. If citizenship and full participation in society depends upon employment, then it follows that employment is a right that should be freely accessible to all citizens, such as the right described in Article 23 section 1-3 of the UN Declaration of Human Rights:

1. Everyone has the right to work, to free choice of employment, to just and favourable conditions of work and to protection against unemployment.
2. Everyone, without any discrimination, has the right to equal pay for equal work.
3. Everyone who works has the right to just and favourable remuneration ensuring for himself and his family an existence worthy of human dignity, and supplemented, if necessary, by other means of social protection.²⁸²

Some Governments in developed economies such as in Europe and North America already adopt unemployment policies, but these programs have a limited conception of employment. Employment is seen as full-time where people are either employed or not, and policies aim to move people from unemployed to employed.²⁸³ Even if automation were not occurring in the economy, these policies are ineffective because of the nature of employment under Cognitive Capitalism: precarious, part-time and contract work with few benefits. This complicates any policy promoting full employment, as they must

²⁸² United Nations General Assembly, *UN Declaration of Human Rights*, Art. 23, § 1-3, accessed May 11, 2016, <http://www.un.org/en/universal-declaration-human-rights/>

²⁸³ Atkinson, *Inequality: What Can Be Done?* 134

integrate a definition of employment that is not a binary choice between working and not working, or there is a risk that work categories such as zero-hour contracts could count towards employment even if they do not result in any paid hours. For instance, policies could focus on time worked or in full-time equivalent work, rather than whether or not someone has employment.²⁸⁴

Anthony Atkinson suggests a policy of guaranteed employment to minimize the occurrence of involuntary unemployment rather than maximizing employment. This would still allow individuals the option to not choose employment, but to provide work for everyone who wants it. He suggests a goal of 2% unemployment, where unemployment takes into account the new forms of work.²⁸⁵ The government should also act as an employer of last resort to ensure the target is met, along the lines of the Works Progress Administration between 1935 and 1943, and direct job creation programs have been enacted before in both the US and in many European countries.²⁸⁶ Under such a system, anyone seeking employment and meeting a certain qualification would be guaranteed a minimum number of hours working for a public institution or approved non-profit at minimum wage. Not requesting employment would not reduce social transfers or benefits.²⁸⁷

In comparison to other unemployment policies, guaranteed employment is a fully active strategy, as government funding would directly subsidize employment to create new jobs to meet the target. This sets it apart from basic income or unemployment

²⁸⁴ Atkinson, *Inequality: What Can Be Done?* 137

²⁸⁵ Ibid., 139-140

²⁸⁶ Ibid., 139-140

²⁸⁷ Ibid., 139-140

insurance which are more passive policies which pass on the funding to citizens directly, or mixed systems which combine both active and passive elements like flexicurity. As mentioned by Atkinson, some countries already pursue active unemployment strategies that include subsidized employment, such as Australia, Germany, and Sweden who spend between 0.3 and 0.67% of GDP on this policy.²⁸⁸ This is in addition to other active and passive policies as well, but direct job subsidies are high when compared to Canada, the US, and Japan, where the direct subsidized job creation is lower in comparison to passive measures.²⁸⁹

There are some objections to this theory that Atkinson covers, such as the difficulty of preserving mobility of labour, the complexity of administration, and the fear of public work crowding out private-sector work. However, in terms of automation one objection to a guaranteed employment policy is that automation results in unemployment because certain work and skills are no longer needed at any wage,²⁹⁰ meaning the success or failure of an employment program would depend on whether or not public institutions could create enough work to be filled, and if they could create more jobs than the available necessary work requires.

Guaranteed employment could have some benefits in terms of Cognitive Capitalism, in that the competitiveness of a company can depend on the quality of a location's education system and public research.²⁹¹ One role for government in this context is in employing academics and researchers to develop basic research which

²⁸⁸ OECD, *Employment Outlook*, July 1997. Paris, pp. 183-190.

²⁸⁹ Ibid, pp. 183-190.

²⁹⁰ Brynolfsson & McAfee, *Second Machine Age*, 179

²⁹¹ Vercellone, "The Becoming Rent of Profit," 272-273

often forms the basis of more specialized research conducted by industries. This may be limited by the education of those seeking work, however, so this benefit could only be fully realized with an education program to accompany the employment program. Government funding employment research and education, as it is not in the pursuit of profit, could result in more support of the improvement of the General Intellect. This differs from the following flexicurity system in that education is a goal in the pursuit of basic research employment rather than a means of skills training for general employment.

Change What It Means to be Unemployed: Denmark's Flexicurity

Denmark has developed another potential policy response in a system that includes both a passive program of income support for the unemployed and an active education program for upgrading skills, a system often cited as a model for other welfare systems.²⁹² This flexicurity model is based on the idea that gaps in employment are a part of the labour process and that citizens should not be penalized for a structural feature of the labour market. The system aims to give the unemployed rights and benefits without negatively affecting the flexibility of the labour market and choice of workers, ensuring that people have the ability to participate in active society, even if not through full-time employment and independent of their employment income.²⁹³ Denmark manages this by giving generous unemployment benefits and state-funded skills-training to help workers find new employment quickly. Rather than a source of

²⁹² Sylvain Lefèvre et. al., *La Pauvreté* (Montreal: Champ Libre, Les Presses de l'Université de Montréal, 2011), 39

²⁹³ *Ibid.*, 46-47

worry and insecurity, flexibility and unemployment are taken as a chance to train and try new activities and jobs, promoting employment security over job security.²⁹⁴

The system is based around a "golden triangle": allowing for the maximum flexibility of the labour market, a sufficient and reliable individual income to protect against social risks through wages or generous social transfers, and labour market activation policies designed to help people develop skills and gain new employment.²⁹⁵ Flexibility is maintained through rules which make it quick and easy for business to hire and lay off workers as the company deems necessary.²⁹⁶ This system has resulted in one of the most dynamic labour markets in Europe, with between 25% and 35% of the workforce changing jobs each year and between a quarter and a third of the workforce experiencing a period of unemployment every year. Although this seems high, these periods of unemployment are mostly short-term, and long-term unemployment only makes up a minority of joblessness.²⁹⁷ This makes a difference, as the Danish flexicurity system allows business to adapt their workforces to meet demand and market conditions to keep competitive while protecting the labour force from the pressures and insecurity this state of affairs would otherwise bring. Danish citizens do not fear losing their jobs because despite the high numbers of short-term unemployment every year, unemployment in Denmark can be an opportunity to find new and better jobs.²⁹⁸

²⁹⁴ "Flexicurity," accessed February 16, 2016, <http://denmark.dk/en/society/welfare/flexicurity/>

²⁹⁵ Lefèvre et. al., *La Pauvreté*, 40-41

²⁹⁶ Denmark.dk, *Flexicurity*

²⁹⁷ Lefèvre et. al., *La Pauvreté*, 42

²⁹⁸ Denmark.dk, *Flexicurity*

Flexicurity also benefits business and workers by continuously creating a better qualified and more capable workforce. Part of the central guarantee of flexicurity is a contract between the citizens and the state, where in exchange for generous social support citizens have a duty to take advantage of job activation services to improve themselves.²⁹⁹ To meet their side of the guarantee, the Danish government offers training courses, work qualifications and work experience through subsidized private sector employment and temporary public sector employment. Training courses not only focus on specific skills development and general education, but on personal development such as self-esteem and competency, as well as programs to assist in the job search.³⁰⁰ Participation in these programs is a condition for receiving unemployment benefits, although these benefits are more generous than comparable benefits in other countries.³⁰¹ Social welfare payments are mostly financed through taxation, meaning income taxes are relatively high, in some cases over 50%.³⁰²

The Danish system also has generous leave policies that allow for a form of work sharing and an opportunity for increased income for the unemployed. Any employee at the Danish company may take a year of leave divided into any portions the employee wants. For the period of time the employee is on leave, another unemployed worker will take their place and receive the equivalent of 70% of their unemployment benefit.³⁰³ This means for each job, multiple people can be employed, and the primary job-holder

²⁹⁹ Lefèvre et. al., *La Pauvreté*, 45

³⁰⁰ Lefèvre et. al., *La Pauvreté*, 45

³⁰¹ Ibid., 45

³⁰² Ibid., 49

³⁰³ Gorz, *Reclaiming Work*, 95

gains more leave to rest and spend time with family. While the original intent of the system was to allow individuals to choose their time off, trade unions in Denmark have organized their labour force to use the system to increase the total amount of employment while reducing the worked hours on a national level. This has had the effect of collectively reducing the working hours by 25%, but only decreasing earnings by 9%.³⁰⁴ This type of national organization is possible in Denmark because of the high level of unionization, with 80% of Danish employment unionized in 2006.³⁰⁵

André Gorz writes that what defines the Danish system is that instead of subsidizing work to induce companies to hire more people, the system recognizes and subsidizes non-work to allow workers more power in self-organization.³⁰⁶ Part of the Danish system's success comes from accepting structural explanations for unemployment, and collectively assuming the burdens of passively suffered job loss. Non-work is recognized as a choice, and workers are not to be blamed or lose the right to participate in society for passively suffered unemployment brought about by factors beyond their control.³⁰⁷ It also separates the continuity of income from the continuity of work, and recognizes that just because the labour market requires flexibility in terms of discontinuous work, this does not mean that people lose the right to the continuous income they need. The Danish system also challenges the ideology of individual work by promoting collective ideals, such as work sharing and state-funded education for all, as

³⁰⁴ Ibid., 95

³⁰⁵ Lefèvre et. al., *La Pauvreté*, 51

³⁰⁶ Gorz, *Reclaiming Work*, 96

³⁰⁷ Ibid., 96

well as legitimating unemployment.³⁰⁸ The costs for education and support are assumed by the state rather than the individual, which assists people retrain and redefine themselves. All told, these measures mean the employment relationship under this system loses the forcefulness of the last chapter as the push towards employment in the Danish economy changes with the context out of recognition that factors beyond the individual can matter. Flexicurity takes on a character of helping the individual along as situations allow towards employment that can benefit the individual as well as the employer, rather than the unregulated job markets in other economies where the constant pressure to take any job at all costs can remove personal choice in employment, or result in individual hardship if employment is not available.

Unlike guaranteed employment, flexicurity focuses on the development and education of the workforce and their relationship to the labour market rather than creating work to suit the population. This could better allow the population to compete with advancing automation through improvement in skills and capability. Although this is similar to the current dominant discourse related to automation and education mentioned before, unlike the current system flexicurity has the state assume the costs of that education rather than making it a matter of personal responsibility. Flexicurity's recognition of involuntary unemployment and structural pressures that are beyond the control of the individual allows it to address automation as such a structural factor. The opportunities afforded by work sharing are particularly important in this regard, as automation as a structural force decreases the amount of necessary work in society, and work sharing allows more people access to this supply of work.

³⁰⁸ Ibid., 96-97

One disadvantage with the flexicurity approach is the type of structural labour market imbalance the system was designed to overcome compared to the tension brought about by automation. The flexicurity regime is designed to overcome labour supply problems where the labour demand is greater than the available supply, a concern of both government and private enterprise.³⁰⁹ Flexicurity's focus on education allows the labour force to upgrade to the skills demanded, growing the labour supply and adapting it to meet demand.³¹⁰ While this is a good policy in that education helps workers stay ahead of automation as long as possible, in the future education may not be sufficient for workers to gain a competitive advantage, and the structural problem change to one of labour demand rather than labour supply. Still, even though this may put a time limit on how long such a policy could be effective in supporting a population unemployed through automation, Gorz considers the Danish system to be an excellent transition into a basic income system. He believes that as the quantity of work decreases and the periods of unemployment per person increases that the unemployment benefits will become an effective basic income system when the percentage of income earned from state payments is greater than that earned from employment.³¹¹ Flexicurity thus may work best when paired with another system that can absorb the larger unemployed labour force automation could produce, and could be an answer to the question of how to transition away from the current economic model.

³⁰⁹ Lefèvre et. al., *La Pauvreté*, 45

³¹⁰ Ibid., 45

³¹¹ Gorz, *Reclaiming Work*, 97-98

Separate Income From Employment: Basic Income

If the threat to people from automation comes from the loss of income the replacement of jobs results in, one response would be to partially replace income from wages with income from another source. Having a guaranteed income from a source other than employment is a popular idea on both sides of the political spectrum, and has had support in various forms and for various reasons since before it has been associated with automation. Different terms for this method include the Negative Income Tax, Basic Income, or Guaranteed Minimum Income. Basic income systems are also popular in Cognitive Capitalism, as both Moulner, Bontang, Vercellone and others support this type of income to address the instability and exploitation in Cognitive Capitalism. The agreement on the presence of a basic income does not mean all of these systems are the same, as there is debate over what the income amount should be and how it should be distributed. Nevertheless, basic income of some form separates income from employment, which could maintain people's income without the need for employment given that automation stands to reduce the amount of available employment in society.

Basic income has been advanced in the past as a means of protecting people from the free market on the basis of fairness. Hayek supports a "system of public relief which provides a uniform minimum for all instances of proved need, so that no member of a community need be in want of food or shelter."³¹² Where Hayek believes the argument lies is not whether there should be support, but in whether this universal minimum should exceed the amount of proven need. For instances where workers find themselves

³¹² Hayek, *The Constitution of Liberty*, 424

unemployed by forces beyond their control, Hayek writes that "there is force in this argument, so far as widespread employment during a depression is concerned."³¹³ In most circumstances, however, Hayek believes that unemployment is caused by declining industries, seasonal work, and unionization artificially inflating wages beyond what the market can sustain.³¹⁴ Hayek argues that worker mobility and a flexibility in the wages that they will accept can solve unemployment in these situations. In Western countries, Hayek believes that unionization and the resulting wage pressure is responsible for unemployment, and unemployment insurance above the minimum only removes the responsibility for unemployment from the unions and has the state assume it, which also will "make the employment problem more acute."³¹⁵ Nevertheless, although "any further provision required for the maintenance of the accustomed standards should be left to competitive and voluntary efforts" the state could provide "a uniform minimum for all who are unable to maintain themselves."³¹⁶

Milton Friedman also supports a policy to "set a floor under the standard of life of every person in the community" through what he calls a negative income tax.³¹⁷ Friedman believes that government involvement in poverty reduction is legitimate because private charity is insufficient, a fact he attributes to the neighbourhood effect. The neighbourhood effect is where everyone would benefit from poverty reduction, but no one would wish to contribute unless they had assurances that everyone else would

³¹³ Ibid., 425

³¹⁴ Ibid., 425

³¹⁵ Hayek, *The Constitution of Liberty*, 426

³¹⁶ Ibid., 426

³¹⁷ Milton Friedman & Rose D. Friedman, *Capitalism And Freedom* (Chicago: University of Chicago Press, 2002), 191-192

contribute, to avoid free-riders.³¹⁸ Friedman proposes a negative income tax as a mechanism to enact a minimum income which would establish the minimum standard of living.³¹⁹ The United States at the time of Friedman's book had a tax exemption of \$600 per person plus a 10% flat deduction, so that people would earn up to 600\$ without having any taxable income. Under Friedman's plan, people earning an income below this exemption level would "pay" a negative tax, which would mean they received a subsidy equal to the amount they earned below the rate, instead of only having their income exempted. The subsidy would scale with the same taxation rate that exists above the exemption, and include existing deductions such as for medical expenses.³²⁰ Friedman opposes social welfare programs such as Old Age and Survivors Insurance, Farm Price Supports, and Minimum Wage Laws, and believes that a negative income tax administered through the existing system could substitute for many existing programs. Using the amount of money spent on social welfare in 1961, \$33 billion, Friedman estimates that the 10% with the lowest income could have received an income of \$6000 per person, or alternatively one-third of the population could have received \$2000 per person.³²¹ Correcting for inflation, that would result in a yearly income of \$47, 541 for the lowest 10%, or \$15, 847 for one-third of the 1961 population in 2016 dollars.³²² Friedman also prefers this to a separate system of a "fixed minimum," where

³¹⁸ Ibid., 191-192

³¹⁹ Ibid., 191-192

³²⁰ Friedman, *Capitalism And Freedom*, 192

³²¹ Ibid., 193

³²² Bureau of Labour Statistics, "CPI inflation Calculator," *Databases, Tables, & Calculators by Subject*, accessed March 10, 2016, http://www.bls.gov/data/inflation_calculator.htm

incomes are supplemented up to an established level.³²³ The purpose of Friedman's system is to reduce poverty and provide a standard of living without distorting the market. Like Hayek, this means that poverty reduction is argued on the basis of an equal right to freedom. The minimum income of Hayek and Friedman can work with capitalism without disrupting it, but capitalism does not depend on it.

Basic income of this nature came close to implementation in the United States in the 1960s. Martin Luther King wrote in 1967 in support of a guaranteed income, because

"...dislocations in the market operation of our economy and the prevalence of discrimination thrust people into idleness and bind them in constant or frequent unemployment against their will."³²⁴

In 1968 more than 1,200 economists signed a letter in support of a basic income policy, and the next year Richard Nixon proposed a Family Assistance Plan that adopted many features of basic income. The policy was abandoned by the time of Nixon's 1972 campaign in the face of combined opposition from caseworkers in existing support programs fearing the cancellation of other social programs and voters who opposed the idea of financially supporting people who could work but chose not to.³²⁵ Although it was not enacted, basic income as a policy reached the threshold of implementation as a means of maintaining a social minimum.

³²³ Friedman, *Capitalism And Freedom*, 192

³²⁴ Martin Luther King, *Chaos or Community?* (New York: Row, 1967), 163

³²⁵ Brynolfsson & McAfee, *Second Machine Age*, 233

Basic income is also advocated in Cognitive Capitalism, but takes on an economic role of stabilizing the cognitive economy and enabling it to expand beyond the limits of capitalism, rather than an ethical or welfare policy relating to human dignity or freedom. Moulier Boutang, Vercellone, Jean-Marie Monnier, Stefano Lucarelli, and Andrea Fumagalli support a basic primary income because they believe that it is the only means to provide a collective social income to enable and recognize the collective production of the General Intellect. As mentioned in earlier chapters, the activity of the General Intellect goes beyond the individually recognized work recognized and remunerated by the wage relationship. Basic income is not paid out as a matter of fairness but as a necessary means of stabilizing the economy by enabling the continual reproduction of the General Intellect.

To Vercellone and Monnier, basic income should be approached not as a welfare program or wage subsidy but as a primary income. To them, Basic Primary Income (BPI) is not a redistributive subsidy or secondary supporting income, but an income earned from currently unrecognized social labour, a way to recognize "the social character of the creation of wealth."³²⁶ Basic income would then become part of the process of reconsidering productivity in the economy and reconceptualizing income to reflect the new forms of labour under Cognitive Capitalism.³²⁷ This provides a different justification than existing arguments for basic income that focus on social justice and the right to choose a good life. In essence, if labour and wealth creation have a social and collective nature, income as a counterpart should reflect this social character. BPI

³²⁶ Carlo Vercellone & Jean-Marie Monnier, "The Foundations and Funding of Basic Income as Primary Income," *Basic Income Studies* 2014, 2-3

³²⁷ *Ibid.*, 2, 7

would partially reward this ongoing collective activity as "social wages," a share of the non-market wealth generated by human activity.³²⁸ Vercellone and Monnier argue that BPI in this framework is not in the public sphere but "the rendering common of what is produced in common."³²⁹

Lucarelli and Fumagalli also consider basic income as "an economic intervention necessary to deal with the unprecedented flexibilization of the labour market" and "an indispensable structural policy for achieving a healthier social order."³³⁰ Lucarelli and Fumagalli define basic income as "the proposal of a universal and unconditional economic intervention," a perpetual allowance "independent of the actual working activity that would guarantee to each member of a given community a decent living standard."³³¹ Similarly to Vercellone and Monnier, Lucarelli and Fumagalli consider basic income as a social wage to compensate and maintain social production by more fairly distributing productivity gains. Currently, wage growth is not indexed to productivity, and paradoxically an increase in productivity through the general intellect result in a reduction of growth and employment, which hurts consumption. Growth is therefore only maintained through public expenditure, as precarious employment provides insufficient wages for private industry to generate growth alone.³³² Basic income becomes a compromise between labour and capital to reduce the instability of

³²⁸ Ibid., 8-9

³²⁹ Ibid., 10

³³⁰ Stefano Lucarelli & Andrea Fumagalli, "Basic Income and Productivity in Cognitive Capitalism," *Review of Social Economy* 66(1) 2008, 72

³³¹ Ibid., 73

³³² Ibid., 82

Cognitive Capitalism, as investment in Cognitive Capitalism depends on positive externalities and a level of aggregate income that is distributed.³³³

Yann Moulier Boutang also argues that basic income is a way of moving beyond the wage system. Just as the abolition of slavery was needed to move beyond mercantile capitalism to industrial capitalism, Moulier Boutang argues that moving beyond the wage system will allow the stabilization of Cognitive Capitalism as a regime of accumulation and that basic income is a method of doing so.³³⁴ A basic income is meant to solve the problem in Cognitive Capitalism that productive activity does not produce jobs, and that a guaranteed income is needed to maintain the productive population.³³⁵

All three of these arguments for basic income in Cognitive Capitalism focus on the same issue: the wage relationship is seen as holding back both employees in the economy and holding back the economy itself, due to people in society being unable to support themselves outside of the wage relationship. Economic growth is not possible even with rising productivity because the wage relationship does not share the rewards from productive activity, which could lead to social or political instability. Basic income in this way is a social wage to remunerate the collective productivity that currently people contribute to without monetary return. With cognitive automation showing a potential to erode jobs in the economy, its combination with basic income could work in the cognitive capitalist context to provide an exit ramp, an opening to transition away from the capitalist structures of the modern economy by allowing the cognitive and collective elements to grow beyond their existing constraints.

³³³ Ibid., 85

³³⁴ Moulier Boutang, *Cognitive Capitalism*, 160

³³⁵ Moulier Boutang, *Cognitive Capitalism*, 166

Automation And Basic Income

The initial argument for basic income in response to automation parallels the arguments from Cognitive Capitalism. Employment subject to the wage relationship is at the heart of the fear of automation in the same way as Cognitive Capitalism, as the loss of income from employment is more threatening when it is the only sufficient or legitimate source. If basic income removes that institutional constraint, the loss of income from employment could be far less threatening, even though the process of automation itself proceeds independent of the change. But when the framework of Cognitive Capitalism is applied to basic income and automation, some similarities can be found.

One argument shared by the authors earlier is that a basic income in Cognitive Capitalism would promote economic growth and maintain production by supporting people independently of the wage-relationship in recognition that not all productive activity is supported by it, allowing this economically necessary activity to continue. Martin Ford makes a similar argument economically, saying that while automation increases productivity it hurts overall employment which in turn hurts demand as the middle class consumers drain their savings and credit to support spending. A basic income allows the consumer market to instead be treated as "a renewable resource."³³⁶ Regenerating the consumer spending capacities of society as a whole would allow growth to continue, and if automation adds to overall wealth to a significant degree, the amount of income could also increase.³³⁷ The existence of a guaranteed income may also

³³⁶ Ford, *Rise of the Robots*, 264

³³⁷ *Ibid.*, 265, 266

help economic growth due to the Peltzman effect, where the existence of an economic baseline would give people a sense of security and free them to take more economic risks such as creating new businesses, services, and websites.³³⁸ This could both engage creativity in creating new economic activity, and makes work an individual choice.

Erik Brynjolfsson and Andrew McAfee also touch on basic income as a long-term policy recommendation to replace the lost income from employment. In the short term, they focus on issues such as developing infrastructure, education reform, taxes on negative externalities, and taxes on economic rent to encourage economic growth.³³⁹ In the long-term, however, they feel these policies will not be sufficient as the capabilities of automation increase and labour becomes less and less in demand. As digital labour and automation become more powerful, "companies will be increasingly unwilling to pay people wages that they'll accept and that will allow them to maintain the standard of living to which they've become accustomed."³⁴⁰ Basic income becomes a simple solution to the problem that is straightforward and simple to administer: if the problem is that people can no longer earn money by offering their labour, "give people money."³⁴¹ Brynjolfsson and McAfee prefer a negative income tax to a pure basic income, however, such as taking the existing Earned Income Tax Credit (EITC) in the United States, expanding it and making it universal and easy to access. They argue that this would help

³³⁸ Ibid., 266

³³⁹ Brynjolfsson & McAfee, *Second Machine Age*, 206-228

³⁴⁰ Ibid., 232

³⁴¹ Ibid., 232

subsidize employment where possible, due to the social benefits and individual fulfillment that people still derive from work.³⁴²

Ford also writes that automation gives basic income an ethical justification, arguing that labour-saving and labour-substitutive technologies stem from "a cumulative effort that has spanned generations and has involved countless individuals, and has often been funded by taxpayers."³⁴³ If automation technology is the product of generations of societal effort and a resource that belongs to all citizens, a guaranteed income can be approached as a "citizen's dividend," where everyone should have at least a minimal claim on a nation's prosperity if automation increasingly contributes to it.³⁴⁴ This is the same connection that Marx makes with the concept of the General Intellect, where the production process depends on "the general state of science and the progress of technology" accumulated by society.³⁴⁵

The direct dependence of A.I. on human data exhibited by Machine Learning systems could make the connection between automation technology and the General Intellect even more visible. One argument for basic income in cognitive capitalism is that it allows people more free time from earning an income that they can use to engage in the relational activities that produce the General Intellect. As shown by process of Deep Learning programs in Chapter 1, cognitive automation depends on raw data to develop logic, and this relationship could give a concrete technological dimension to this basic income argument, even if human contributions to the data are not known on an

³⁴² Ibid., 238-239

³⁴³ Ford, *Rise of the Robots*, 266

³⁴⁴ Ford, *Rise of the Robots*, 266, 267

³⁴⁵ Marx, *Grundrisse*, Notebook VII, 705

individual level, obscuring the economic relationship. Machine learning and Big Data requires large volumes of input, and the same activities that Cognitive Capitalism theorists hope basic income will promote could also be activities to make automation more capable and more productive. Through relationships like Watson's use of medical journals and Google's use of European Union documents, cognitive A.I. and networks could be used to show a link between general human knowledge and technical capability, even if the relationship is obscured on an individual level.

Pairing networked A.I. in the cloud with an educated population supported by basic income and with more free time beyond work could result in better outcomes for both people and technology. On a small scale this is observable, such as when Brynjolfsson & McAfee give examples of how A.I. grows more intelligent when paired with humans, such as chess A.I. paired with humans defeating other chess A.I.³⁴⁶ Under the right circumstances, it may be possible to scale this to a societal level as well. The technology seems capable of scaling up to a significant degree, as technology researcher Geoffrey Hinton writes about Deep Learning: "Basically you just need to keep making it bigger and faster, and it will get better."³⁴⁷ If this is the case, then much like companies operating in cognitive fields, cognitive A.I. could benefit from network effects where a larger source of data results in "better" learning and better A.I.. Cognitive Capitalism argues that using basic income to free up time allows people to better contribute to the General Intellect, and looking at how big data from human activity contributes to learning software is one way this could happen. Basic income could exploit a positive

³⁴⁶ Brynjolfsson & McAfee, *Second Machine Age*, 2

³⁴⁷ As quoted in John Markoff, "Scientists See Promise in Deep-Learning Programs," *New York Times*, November 23, 2012, <http://www.nytimes.com/2012/11/24/science/scientists-see-advances-in-deep-learning-as-a-part-of-artificial-intelligence.html>

network effect to increase A.I.'s growth, and stronger A.I. growth could support the growing wealth of the economy.

Whether for economic reasons or for ethical reasons, the most important aspect of basic income and automation is that the wage-relationship's use as a social regulation could become obsolete. The theoretical positive feedback described in the previous paragraphs is made possible by activity outside of work, and with basic income redistributing societal wealth, the wage-relationship is unnecessary. Marx writes that "the workers' struggle against machinery" occurs because of the specific relationship between machines and humans in capitalism, that "this effect of machinery holds only in so far as it is cast into the role of fixed capital, and this is only because the worker relates to it as wage-worker, and the active individual generally, as mere worker."³⁴⁸ Without work and the wage-relationship, perhaps there are more positive scenarios where technology's promise of liberation from subsistence labour could be allowed by redefining the social context with policies such as those described earlier, and not the antagonistic scenarios such as those described by Marx and feared by employees fearing technological unemployment in today's society.

Drawbacks and Challenges of Basic Income

Basic income has some arguments against it, both practical and moral. Even with an ethical justification, basic income will not be possible to enact if there is no practical means to fund it. The distributive mechanisms have already been covered, such as a direct grant or payment through the tax system as a negative income tax. The revenue

³⁴⁸ Marx, *The Grundrisse*, Notebook VII, 702

generating side is more of a challenge. The majority of taxes raised by governments are often individual income taxes, making up nearly half (48%) of Canadian government revenue in 2014-2015³⁴⁹ and 47% of United States receipts in 2015.³⁵⁰ There are also other employment taxes on both employers and employees that support social programs, like payroll taxes supporting Medicare and Social Security in the US³⁵¹ or Employment Insurance premiums in Canada.³⁵² Funding a program to respond to declining levels of work using employment-based taxes will likely not be a sustainable strategy, meaning revenue sources independent of employment may be required.

There are some alternatives to employment taxes that are available. Vercellone & Monnier suggest a complementary strategy of monetary creation and taxation reform, beginning with an assumption of BPI at half the median wage to estimate costs.³⁵³ At the basis of their calculations is the assumption that basic income is a wage like any other, and should be treated as such. For instance, some self-funding may be possible, such as applying the same income tax and social security deduction to BPI as other income, and a revenue from consumption taxes like a Value-Added Tax can be earned when BPI is spent.³⁵⁴ Saving could also be accomplished through the elimination of

³⁴⁹ Department of Finance Canada, "Annual Financial Report of The Government of Canada Fiscal Year 2014-2015," September 14, 2015, accessed March 3, 2016, <http://www.fin.gc.ca/afr-rfa/2015/report-rapport-eng.asp#toc2>

³⁵⁰ White House Office of Management And Budget, "Table S-4. Adjusted Baseline By Category," *Budget of the US Government Fiscal Year 2017*, p.120, accessed March 3, 2016, <https://www.whitehouse.gov/sites/default/files/omb/budget/fy2017/assets/budget.pdf>

³⁵¹ Brynolfsson & McAfee, *Second Machine Age*, 239

³⁵² Canada Revenue Agency, "EI Premium Rates," September 24, 2015, accessed March 3, 2016, <http://www.cra-arc.gc.ca/tx/bsnss/tpcs/pyrll/clcltng/ei/hstrc-eng.html>

³⁵³ Vercellone & Monnier, "The Foundations and Funding of Basic Income as Primary Income," 12

³⁵⁴ *Ibid.*, 14

redundant means-tested social programs. These measures would never be more than partial funding, however, and Vercellone & Monnier advocate taxation reform such as eliminating tax reliefs and implementing taxes on finance and capital, such as a tax on capital gains and a Tobin tax on financial transactions. Fumagalli & Lucarelli also suggest a Tobin tax and a tax on both rent from intellectual property and rent of positive externalities in recognition of rent's position as the main source of profit growth.³⁵⁵

The other challenge for basic income to overcome is the ethical challenge related to the culture of work from chapter 3. The central conflict is whether income is a necessary motivation to work, and whether people will choose to occupy themselves differently or not at all when the need for income is removed. Brynjolfsson & McAfee consider a minimum income to be a necessary policy, but they argue that implementing it as a direct basic income would remove the incentive to work. They cite the other benefits of work, such as mastery, as sense of purpose, and autonomy, and a study that shows that communities with low unemployment are healthier than those with higher unemployment.³⁵⁶ Communities with poor populations differ when the poor are employed vs unemployed in metrics such as crime, family dissolution, and poor social organization. This is why they prefer the negative income tax as a way of ensuring the social minimum like basic income but with an incentive to work.³⁵⁷ Moulier Boutang writes, however, that when defined by the conditions of unconditionality,

³⁵⁵ Lucarelli & Fumagalli, "Basic Income and Productivity in Cognitive Capitalism," 87

³⁵⁶ Brynjolfsson & McAfee, *Second Machine Age*, 234-235

³⁵⁷ *Ibid.*, 238

cumulativeness, and sufficiency, any distinctions between basic income and negative income taxes disappear.³⁵⁸

When it comes to countering the moral case for work, one counterargument is that income is not the only motivational factor. If work provides many benefits beyond income, why is the coercive mechanism of the wage relationship so important, and are jobs the only source of these benefits? Moulner Boutang argues that the current paradigm of work in culture and economics assumes that the only motivations for work are those of satisfying material needs and desires, *libido sentiendi*, or the desire to dominate and exercise power over subordinates, *libido dominandi*.³⁵⁹ The discipline of the wage relationship would stem from the first, as material goods need an income to be acquired, and employment is a means to that end. But in the modern economy, Moulner Boutang notes, many activities are done that meet neither of these conditions, and many of these tasks are enabled by the "peer network" through new information technology, things like Open Source software and Wikipedia. Moulner Boutang argues that this is proof that there is motivation to work beyond material incentives. People contributing to Wikipedia or other peer networks do not get concrete material rewards, but are motivated by *libido sciendi* or a pleasure in learning and knowledge.³⁶⁰ This form of motivation is not just a desire to know, but includes sharing and cooperation, and it is the existence of this motivation that enables the positive externalities and "free labour" that companies capture.³⁶¹

³⁵⁸ Moulner Boutang, *Cognitive Capitalism*, 156

³⁵⁹ *Ibid.*, 76

³⁶⁰ Moulner Boutang, *Cognitive Capitalism*, 76

³⁶¹ *Ibid.*, 77

The philosophical debate over the morality and motivation for work has been contentious, given the established paradigm that places work at the center of society, and this can be seen in the aftermath of attempted studies of basic income in the 1970s. Between 1974 and 1979, a Canadian Guaranteed Annual Income field test was run by the Province of Manitoba and Government of Canada in Dauphin, Manitoba and Winnipeg, Manitoba, called MINCOME. This study was terminated without a final report due to the deteriorating economic condition of the 1970s and a loss of political support, and without the anticipated universal program that MINCOME was intended to introduce. Several experiments were also run in the early 1970s in the United States, such as the Income Maintenance Experiments in Seattle and Denver (SIME-DIME).³⁶² The SIME-DIME experiments generally showed a small decrease in working efforts for primary household workers, while secondary workers, often women, would use the income to afford more time for household activities. Tertiary household earners, mostly youth, reduced their working hours significantly but only because they entered the workforce at a later date, possibly spending more years in school. Similar data was found in other studies, such as one in North Carolina. The statistics that resulted in the loss of support for the programs, however, was the rate of family dissolution which saw divorce rates increase between 53% and 57% for caucasian families and african-american families respectively, although this was later shown to be a statistical error.³⁶³ The MINCOME experiment, when evaluated by Evelyn Forget years later, produced similar results in Winnipeg where primary wage earners showed little change in

³⁶² Evelyn L. Forget, "The Town With No Poverty," *Canadian Public Policy* 37(3) 2011, 285-286, 287

³⁶³ Forget, "The Town With No Poverty," 285, 286

working behaviour while secondary and tertiary earners showed some moderate changes.³⁶⁴ The second sample in Dauphin, however, consisted of an entire community of 10,000 including those outside of the labour force such as the elderly and disabled, allowing some further conclusions to be drawn. The improvement to health and social outcomes were more widespread than the payments of the program itself, as even though only one-third of the town qualified for direct payments, hospitalization rates for Dauphin fell by 8.5% relative to the control group, indicating that basic income may improve health outcomes on a community level.³⁶⁵

Initial studies therefore not only show that the impact of basic income on labour market participation is moderate at most, but that health outcomes can also improve. If both basic income and work have benefits for people, and basic income does not necessarily preclude work or lead to recipients dropping out of the labour market, then perhaps it is possible that the benefits of a basic income can add to the benefits of work. Even so, the basic income suggested by cognitive capitalism and automation is in response to a decreasing amount of work occurring independently of basic income, meaning it is not a problem of a labour force declining when work remains to be done, but a way of supporting a labour force when not every member can be employed in the available recognized waged work. Hayek wrote that "there is no more poignant grief than that arising from a sense of how useful one might have been to one's fellow man and of one's gifts having been wasted."³⁶⁶ This grief may not materialize if those talents were not required, and if the technology took on more of the role of supporting "one's

³⁶⁴ Ibid., 288, 289

³⁶⁵ Ibid., 299, 300

³⁶⁶ Hayek, *The Constitution Of Liberty*, 143

fellow man" without so much necessary employment. In the automation scenario work is not being left undone, and people are not free riders of other people's labour, so there may be less fear of letting others down.

One final issue to note with basic income, however, is that it is a corrective mechanism to the current societal context rather than a new construction entirely, and still makes use of the underlying structures of capitalism which are needed to create wealth to redistribute. For instance, although the cognitive capitalist justification for basic income involves ensuring collectively recognizing and supporting the General Intellect that individual wages were less capable of doing, basic income does not help to solve the crisis of value in either its marginal-utility form or labour-time value form. The remaining value question also means that the commodification of immaterial goods still exists as the rentier mechanisms such as intellectual property are still required to enable this form of wealth production, as is the financial infrastructure to which the Tobin tax could be applied, or else there would be less wealth to tax and redistribute as a basic income in the first place.

The addition of basic income to automation changes the framework of the argument back from jobs as a goal of human life to the views of Mill and Keynes where jobs as necessary work should eventually be overcome, and make it possible to achieve the liberation of humanity from the struggle of subsistence. And following Marx's views on machinery, freeing people from work also frees them from the struggle against machines, which only takes place in the wage relationship. Work will still exist to be done, but it may not have the same character of productive, subsistence jobs that sustained life through earlier historical periods. Other productive, socially beneficial

activities in art, culture, creativity, and innovation could still exist in the economy, especially since true creativity by A.I. is still not possible,³⁶⁷ but amateur expressions of these activities could thrive outside of the market, as well as other activities such as the peer-network online activities described by Moulier Boutang, political engagement and public service, other volunteering, and physical activity. Keynes' prediction that the "economic problem" may one day be solved could return to a liberating and desirable future rather than one to be feared. Automation may not make all work disappear, but it can make it possible to rethink what work is rewarded as being legitimate and productive, broaden how people think about contributing to society, and remove the constraint to work, allowing people more choice in how to live their life while at the same time making remaining labour more attractive to encourage people to choose it.

³⁶⁷ Frey & Osborne, *The Future of Employment*, 25-26

Conclusion

Freedom From Work or Freedom To Work?

Automation technology has changed as fundamentally as the economy since the combination of the computer and the network. Technology has always been a factor to increase human productivity, but in the last 20 years it has been moving from automation to autonomy, replacing humans in some tasks entirely. It has taken two thousand years, but humans tools have the capability to become the automatons that Aristotle imagined.

The human response to this has tended away from the liberation potential of technology and towards the fear of technology stealing jobs. What this dissertation has aimed to show is that the target of the fear and the central issue should not be the technology, but the choices society makes in applying the technology, as the same technology can either reduce the amount of necessary labour and worsen the precarious nature of jobs or liberate individuals from the constraint to work depending on the social context. The fear of losing jobs can be concerned with the job itself, as jobs have been shown to have social and psychological benefits for people, but primarily the loss of jobs is feared because of the loss of wages, which is the primary means of income for most people.

Viewed through the lens of Cognitive Capitalism, workers in the current economy are already seeing their wages eroded, partially through job losses but primarily through a decrease in job quality due to a fundamental incompatibility between the nature of modern employment and traditional means of assessing the value of compensation. Cognitive Capitalism argues that this is because the capitalist economy has adapted to

the decline in profits of material production by rearranging itself around the accumulation and production of immaterial goods as a new source of economic growth and profit. Material production continues, but it is the immaterial content of material goods that forms the source of their economic value. Immaterial goods pose a problem to traditional economic models, however, because these goods are zero marginal cost goods, and in economic theory prices are set by the marginal cost of production. Immaterial goods resist this system of valorization, and depend on other means of setting value and prices.

The alternative theory for valorizing goods, the labour theory of value, helps in understanding why cognitive labour is hard to valorize. Labour still is central to value, but rather than adding value in the process of production, labour becomes an embodiment of value through the activities of the General Intellect, the sum of scientific and social knowledge in society and the process of increasing it. Cognitive labour is used by employers to capture and accumulate this collective knowledge using rentier mechanisms to claim ownership and assign value in order to profit from immaterial production. This new form of labour makes direct management under Taylorist principles impossible, requiring new indirect means of coercion such as an internalization of workplace culture, surveillance technologies in the workplace, and most importantly a precarization of the wage relationship resulting in more part-time and contract work at the expense of stable careers. This has the effect of making these jobs even more important in people's lives, but new automation technology now has the potential to replace many forms of cognitive employment.

Jobs in the cognitive economy consist of applying human experience and human knowledge in producing goods with information content which are subject to intellectual property laws. A learning A.I. embedded in information networks can take over some of the repetitive roles and support services. One way that A.I. in this context can accomplish this is that A.I. can become an immaterial good capable of embodying human experience, allowing A.I. to complete tasks using that experience. This obscures the economic relationship to individuals and allows A.I. to take the place of people. With technology now able to complete more human tasks autonomously, the demand for human labour decreases. This either leads to a decrease in the work needed for each job, leading to part-time work, or fewer jobs. Cognitive automation also stands to automate the jobs that form the growth sector of the immaterial economy, with the equivalent productivity of 75 to 90 million full-time knowledge workers in developed countries and a further 30 to 55 million workers in developing countries.³⁶⁸

This tension is what drives the fear of automation. While technological developments and economic incentives are replacing jobs and reducing the need for labour, ideology and institutions maintains work at the center of social life. Work is seen as moral and virtuous, and people who are unemployed are stigmatized by welfare systems designed to support them. Jobs are turned into a valuable commodity, and people look to the economy as a means of producing jobs rather than a means to contribute and generate wealth in society. The precarious wage relationship is the institutional means of maintaining this situation. Monetary income is required in society, such as for paying taxes, and for the vast majority wages are the primary means

³⁶⁸ McKinsey Global Institute, *Disruptive Technologies*, 44

of income. This coerces people into work out of necessity, and jobs become the means of survival. Blairist workfare systems work on the same principle: people are driven to employment for income, so by limiting the duration of benefits and tying them to job searching and other conditions people can be pushed into work. Automation removes labour demand so that there are fewer jobs to be pushed into, but the coercion to work remains.

There are various responses to address this tension between a coercion to work in an environment with decreasing quantities of work. One option proposed for ensuring fairer distributions of income is guaranteed employment. This preserves the wage relationship, but attempts to overcome the precarity of income. The challenge here is that reducing precarity alone may not be enough, and that there may not be enough work to support the number of jobs required to provide widespread income. This form of distribution may also not be conducive to the types of activity required for the cognitive economy, given that it is a change in the nature of work and the crisis of valorizing labour that are contributing to the problems of precarity and wages. Introducing automation into this environment would be challenging, as automation could reduce the amount of work necessary for society. Assigning enough work per citizen would make automation an obstacle for the government.

Another solution is a strengthened welfare system, similar to the flexicurity of the Nordic model. Denmark defines flexicurity in terms of the Golden Triangle, and the main goal is to ensure workers do not fear losing their jobs by promoting "employment security" over job security. Rules for hiring and firing remain flexible, allowing companies room to act during downturns and restructuring. Unemployment benefits

are significant, in some cases up to 90%. The third and final factor is active social policy, such as state-provided job training and counselling to educate and retrain workers, to help them find new work and reduce the stress and uncertainty of unemployment.³⁶⁹ The advantages of this system is the focus on individuals and maintaining income support, while also providing for constant education and learning. As with the guaranteed employment scheme, introducing automation would reduce the amount of certain kinds of work available, but this system's focus on the state assuming the costs and risks of education make it more resistant, as education is the key to gaining good employment in the face of automation. This system could also function as an effective transition into a basic income system.

Moulier Boutang, Gorz, and Vercellone all argue for a form of basic or guaranteed income on the basis that everyone contributes to creative process at the center of modern economic growth, although it is not a remuneration of that fact. The basic income recognizes that the work-life balance is reversed, and that life is a precondition to working well. If people's basic needs are provided for, they will be freed to engage in the social activities and self-improvement needed for economic growth. A basic income, as well as liberating people, is also about stabilizing an economy of knowledge production, and making sure the environment for social interaction and innovation is sustainable.³⁷⁰ Automation in this environment could be a benefit, as the economically rewarding activities which a basic income is intended to encourage are precisely the activities automation cannot replace. The nature of automation and the cognitive

³⁶⁹ Denmark.dk, "Flexicurity,"

³⁷⁰ Moulier Boutang, *Cognitive Capitalism*, 158

economy ensures that humans will remain the center of economic focus. Similarly, the tasks that automation can replace could free up more people from some of the neo-Taylorist support roles, like shipping, manufacturing, and processing, to fully participate in the activities necessary for economic growth, contributing to a stability of the economic system. People will no longer need to be disciplined into certain forms of work, provided those jobs can be automated. Automation could contribute to the optimistic future that Keynes predicted, in the right circumstance.

This dissertation has focused on the theoretical aspects of the relationship between automation, work, and income to determine the outcome on people's lives. As Yann Moulier Boutang writes, however, the economy does not exist in a bubble, and we must consider ecology and the biosphere in planning for the future. Moulier Boutang writes that the economy is only concerned with the here and now, and that the biosphere of earth regenerates on timescales beyond that of humans. Harvesting resources beyond the Earth's capacity results in a negative externality which in time can harm the economic system irreparably: "At stake here is nothing less than the survival of the planet as a living whole."³⁷¹

One future area of study could therefore be how automation play into climate change and the depletion of Earth's resources. Automation results in higher productivity and efficiency, which economically reduces the demand for labour, but could this increase the demands for inputs, hastening the depletion of Earth's resources? Or could increased efficiency and the omnipresence of networked A.I. lead to less waste, reducing the inputs needed for the same outputs? A switch to pure

³⁷¹ Moulier Boutang, *Cognitive Capitalism*, 16, 18

immaterial goods such as software and a decreased reliance on hardware could also have an impact on resource extraction, especially if renewable energy sources can increasingly and effectively substitute for energy from fossil fuels.

Automation could also change the governance of society. All of the policies described in Chapter 4 cover policies implemented by states in today's economy, meant to protect individuals now from the potential of future transitions without indicating what is beyond the transition. If society coexists with automation for long periods of time, there is a possibility of new forms of society developing that have not yet been conceived. Intelligent networks and networked individuals, backed by basic income, could lead to new forms of community and interaction only hinted at by the peer economy and social media. There are also questions about the ethical behaviour of A.I. itself, since without a human in the decision-making process, how is one to judge a robot's decision that results in injury or fatality? One area where this could be important is in combat robotics, such as when Stephen Hawking, Elon Musk, Steve Wozniak and 20, 806 others supported an open letter by the Future of Life Institute advocating against A.I. in military technology.³⁷² This letter states that "Starting a military AI arms race is a bad idea, and should be prevented by a ban on offensive autonomous weapons beyond meaningful human control."³⁷³

For the present, though, there is room for optimism. Marx wrote that the relationship between the worker and the machine is one of struggle, where the worker is subsumed by the machine and becomes a linkage between the machines various

³⁷² Future of Life Institute, "Autonomous Weapons: An Open Letter from AI and Robotics Researchers," Future of Life Institute, July 28, 2015, accessed April 3, 2016, <http://futureoflife.org/open-letter-autonomous-weapons/>

³⁷³ Future of Life Institute, "Autonomous Weapons,"

functions in the production process, a relationship of eventual domination and appropriation. Making work a choice, rather than a necessity, and adapting technology to make human society more wealthy and productive without making it more unequal could change this relationship to a more positive mutual benefit, and achieve the promise of automation Keynes hoped for. Though technology can replace many necessary tasks, their limitations and the structure of society means they will not replace all activities, but these activities may not necessarily take the form of jobs. Human activities will remain the center of the economy, human desires will determine what production occurs, and human creativity and curiosity will still drive the General Intellect, from which both humans and their technology can benefit from. As André Gorz writes, intelligence is made up of many faculties including ones we have seen A.I. newly developing like learning, judgement, reasoning, memorizing, and adaptability, but that it "develops and assumes meaning only if the implementation of these faculties is required by the pursuit of a goal: by a plan, desire, or need."³⁷⁴ Without this human element, even the most fully automated and artificially intelligent society would lack meaning, and could not evolve and prosper. Mr. Spock also understood this need for a human factor when he says at the end of "The Ultimate Computer:"

"Computers make excellent and efficient servants, but I have no wish to serve under them. Captain, the starship also runs on loyalty to one man. And nothing can replace it, or him."³⁷⁵

³⁷⁴ Gorz, *The Immaterial*, 140-141

³⁷⁵ "The Ultimate Computer," *Star Trek*.

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