“What Do Technology and Artificial Intelligence Mean Today?”

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I. Introduction and Orientation

This chapter appears in a collection devoted to the nature of humanity, the nature of intelligence, the ethical and social challenges posed by emerging technologies, and visions of what the future may hold. In this chapter, we give an overview of key technologies dominating our present time, with a focus on Artificial Intelligence (AI), a term we will chiefly apply toward algorithms. It is illuminating to explore the difficulties in defining the terms “technology” and “artificial intelligence” before we move on to discussing what we observe in the present day, how these situations arose, and our concerns for the near future.

We find it most helpful to consider technology and AI in terms of *how* they occur rather than what they *are*. Rather than discuss technological artifacts *per se*, purely in technical terms as one might find in a trade magazine or textbook, it is primarily the *interaction* between humans and the artifacts of technology that is responsible for the widespread interest in this topic. Given the entanglement between humans and technology implied in this interaction, our approach fits in the general philosophical traditions of “instrumentalism” and the subview of phenomenology (Ihde 1993) as well as the network processes *connecting* humans to each other and to machines (Latour 2007). This entanglement becomes explicit in modern AI applications that both influence our views of the world (Pasquinelli and Joler 2020) and are trained on data about ourselves.

One of the salient features of successful technologies is ironically their tendency to become *non*-salient, that is, to become *unnoticed* parts of the “background” of our daily lives. Marshall McLuhan articulated this in the 1960s: “The effects of technology do not occur at the level of opinions or concepts, but alter sense ratios or patterns of perception steadily and without any resistance” (McLuhan 1964). Technologies that were once revolutionary quickly become accepted, then normalized, then deemed essential, and finally go unnoticed. This loss of saliency is true of things that are now so far in the background that we may not even recognize them as being examples of *technologies*, things such as language and the concept of time (Postman 1993); and the concept of race (Benjamin 2019). Similarly, technologies once deemed “AI” can become part of the background whereby they are no longer regarded as being AI.

The tendency for AI to become part of the background is the first of three challenges identified previously (Hawley 2019) that one encounters when trying to answer the question of “What is AI?” Secondly the scope of the term “AI” can increase as organizations engaging “AI hype” apply the term to the use of centuries-old statistical operations. The third challenge is the obscuring challenge of anthropomorphism, which is unavoidable and results in various forms of cognitive bias (Bryson and Kime 2011). To these three challenges, we add a fourth by asserting that on a fundamental level, *the term “AI” denotes a “family resemblance” in the sense of Wittgenstein* (Wittgenstein 1953) rather than a classical category with well-defined limits. This notion of family resemblance is illustrated in the category of “game”: some games involve competition among two or more players but not all do, some involve the use of special equipment but others do not, etc. (Lakoff 1987). Likewise, some AIs have pre-programmed rules written by human experts (e.g., many game-playing AIs and expert systems) but others “learn” rules from datasets or from “experience,” most perform human-like tasks yet some tasks seem to be beyond the limits of human capabilities such as generating photorealistic fictional human faces (Paez 2019) or learning to replicate audio effects (Mitchell and Hawley 2020).

Some authors approach defining AI by first defining intelligence, such as “being able to do the right thing at the right time” (Bryson 2012), and then placing “artificial” before it. Although this approach can be helpful for many situations, we do not find it providing clarity for our consideration of the scope and impact of AI systems, as “the right thing” may in many situations be poorly-defined (take for example, automated music generation systems) and the concept of time may not always be relevant.

A limit we will *not* place on “AI” is to try to restrict its use to the science fiction of simulating all human cognitive faculties -- typically dubbed Artificial General Intelligence (AGI) or “strong AI” -- which we regard to be of significance for entertainment and far-future concerns for “AI Safety,” but outside the scope of the present and near-future scenarios we will explore in this chapter. In this respect we will follow the urging of machine learning (ML) pioneer Andrew Ng, “Let's cut out the AGI nonsense and spend more time on the urgent problems: Job loss/stagnant wages, undermining democracy, discrimination/bias, wealth inequality” (Ng 2018).

For our present purpose, we will identify “AI” with the use of *algorithms* and their application to information technology (primarily communications and information retrieval), and how through the internet they have transformed and disrupted public and personal life in ways largely unforeseen in the 20th century. What follows are observations of these disruptions.

II. What We Observe Today

Algorithms have become so ubiquitous that it is hard to imagine life without them. Consider every time you pick up your phone to text someone. Before you can type the third letter, an algorithm is offering multiple possibilities of words you could write. These are not general suggestions collected from a static table but include names and places relevant to your individual context. The recommendations are generated a process of ML that takes into account what you have typed in the past along with statistical calculations based on what others have typed in that language. All of this is hidden from view making algorithms look and feel not like the complex mathematical calculations that they are but nothing short of magic. Today, the proverbial “man behind the curtain” is not human but countless lines of binary code making decisions in split seconds that together guide and shape the fate of the Anthropocene.[1]

At the time of this writing, around 5 billion people in the world have mobile devices (Silver 2019) and 3.5 billion of them are smartphones (Turner 2018). It is no longer a luxury of the developed world but part of the global reality. The pervasiveness of phones as part of the human experience opens up a wide array of possibilities never imagined before in history. One could argue that these digital devices are fast becoming extensions of our own bodies. Add to that the fact that the majority of these phones

[1] “Anthropocene” refers to the current geological period we live in where human activity is the dominant factor on the climate and the environment.

are linked to the Internet and we now have the blueprint for what theologian and scientist Teilhard de Chardin described as a Noosphere: an interconnected cloud of human knowledge and experience (Teilhard de Chardin 2002).

Embedded at the center of this ecosystem of humans and devices is the regulating presence of algorithms. These sets of instructions powered by mathematical equations bring order from the chaos of the World Wide Web. Consider, for example, the role that AI plays in social media platforms such as Facebook, Twitter and Instagram. With millions of users posting content by the minute, creating a compelling experience for the billions of people that visit the platforms daily is the task of a complex web of algorithms regulating the relevance of each post to each user. They craft the feed based on the users' past expressed preferences through clicks and scrolling speed, popularity of the post among other users, and the commercial interests of companies paying to advertise on the platform.[2] The result is an individualized experience for each user so unique that no two users see the same content even if they visit the platform at the same time. Social media powered by algorithms enables each human to live their own micro-reality.

Another major gateway to the Internet is the search engine. That is by far how users discover new sites on the web. Google, the undisputed leader in this field, uses a proprietary ever-changing algorithm that ranks sites based on a number of factors which include keywords, links pointing to it, content relevance, and domain name (Page et al. 1999). The result is surprisingly effective, allowing the searcher to find what they need in the first few links listed. Its pervasive use has made the company name a colloquial verb in English. When you don't know something, you "google it." In effect, the search engine, which is now available in billions of phones, is serving as an auxiliary brain (Clark and Chalmers 1998) for humanity allowing light-speed access to information.

The combination of algorithms and hand-held devices are disrupting and reshaping foundational industries such as retail, housing, and transportation. Uber and Lyft have upended the market for rides long dominated by inadequate public transportation systems and inefficient taxi networks. Yet, their influence will not stop there. App-enabled services are now looking to re-shape the car industry by spearheading a push towards autonomous vehicles. Since AlexNet proved that computers could accurately recognize images in late 2012, this opened the door for fully functioning automated transportation (Gershgorn 2017). Computer vision may well replace human vision behind the wheel, completely re-shaping the relationship between people and automobiles. Ride offering companies imagine a world where car ownership is optional and human movement is fully enabled by autonomous vehicles.

Apps-enabled services are not limited to transporting people but have also branched out into things. It was algorithmic enabled services that allowed Amazon to reorient the retail industry away from big box stores into hand-held devices. When governments imposed lockdowns because of COVID, app-enabled services saved the restaurant industry through delivery services like Dash and Uber Eats. They are now moving fast into the housing industry as they disrupt real estate and rent markets. Zillow and Trulia now offer detailed information on houses for sale that was previously only available to real

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[2] The Netflix documentary *The Social Dilemma* paints a vivid picture of this process by having one actor playing three different algorithms. The three versions of the actor have a conversation with each other where they consider the pros and cons of what to show the user.

estate agents. The next step beyond that is found in Open Door which removes human agents from the house selling transaction, directly buying from and selling to individuals.

App-enabled disruption has not been free of criticism. Government and consumer protection groups are halting their advance of these services to better understand their destructive side-effects. In 2018, the city of Seattle banned rent-bidding apps (Pyzyk 2018) like Rentberry and Bidwell so their impact on housing affordability in the city could be assessed. City council members worried that these services were making an already property supply-challenged city even more expensive to live in. It is yet to be seen whether the city's continued ban will encourage other localities to do the same. Yet, the struggle in the Emerald City is emblematic of more battles to come as society absorbs the disorienting impacts of algorithmic businesses.

Even as legal challenges emerge in these unprecedented business scenarios, the judicial system itself is undergoing disruption due to algorithms. ML models are now used to predict and manage risk, such as anticipating which defendants are less likely to show up in court or are most likely to re-offend. These models are highly controversial (Awere 2020) because they are built on past data and therefore tend to replicate existing conditions, such as bias against particular social groups. The models are blind to ideas of justice and fairness, so they can only learn based on the data provided. Furthermore, these algorithms will often produce false positives and other statistical errors which can have life-and-death consequences for defendants. Hence, the thinktank Partnership on AI recommends using such models primarily to speed up the release process of current inmates as opposed to lengthening sentences (Partnership on AI 2019).

Algorithms are fast becoming an integral part of our political systems. In 2018, the world learned about how Cambridge Analytica illegally acquired the personal data of 50 million Americans on Facebook through an add-on app in order to serve micro-targeted political ads in the 2016 election (Ashworth and Gillespie 2018). While the story raised an uproar about personal data safety, the practice of using voter data for political advertising continues. Rich datasets allow campaigns to customize their message to ever smaller voter groups to get out the vote. A recent *NYU Ad Observatory* report (Ryan-Mosley 2020), shows that both the Biden and the Trump campaign in 2020 were harvesting data from Facebook and other platforms to target potential voters and donors. Algorithmic political targeting is here to stay.

Furthermore, there is evidence that Russian bots[3] sowed misinformation to further polarize the American electorate. Roughly 20% of all tweets about the 2016 US presidential election were produced by bots (Schneier 2020). On the other hand, these same ML models are now being deployed to curb corruption in places like Mexico and Ukraine (Aarvik 2019). While the practice is still in its infancy, this application is a promising tool in the battle for a more transparent future. AI is well-suited to detecting anomalies too subtle for human monitoring to catch.

Education is also undergoing disruption through the introduction of algorithms geared toward the customization of the learning experience. While many schools still offer a one-size-fits-all instruction, app-enabled education allows students to progress at their own pace. Math apps can track the child's learning in real-time, adjusting the next question to reinforce a concept missed or advance to new

[3] Bots are automated text generating algorithms that can be trained to send tweets, carry on text interaction with customers and even provide psychological advice.

material (Ashbach 2013). This is empowering large universities to ensure struggling students do not fall through the cracks. Georgia State University has successfully implemented a predictive model to identify students with high likelihood of drop out (Hefling 2019). The models allow administrators to reach out to these students early on with resources and guidance to help them persevere in their academic journey.

Not even romance is immune to the algorithmic revolution! Match-making algorithms seek to pair people based on elaborate questionnaires and a growing database of what has worked in the past. Although such systems have been around for decades (Finkel 2012), it is notable how prevalent they have become. In an age where a staggering 40% of marriages start online (Kopf 2019), algorithms are playing a crucial part in deciding who gets to meet whom. This is an unprecedented change in human society, one which the effects we are yet to fully comprehend. In a recent Pew survey (Perez 2020), more than half of responders believe that relationships online were just as successful as those started through traditional means. Yet, when asked whether they have improved the dating scene, the majority was ambivalent. The jury is still out but algorithmic matchmaking will not go away anytime soon.

Finally, algorithms are also changing how we wage war. The conflicts of the future will not be fought only with soldiers and tanks but also with hackers and bots.[4] A key concern at the moment is regarding autonomous weapons: systems that can pursue a target without human intervention. This would allow a national army to engage in combat without risking human lives. As enticing as this may sound, this scenario would also lower the threshold for war, having an adverse effect on geopolitical stability. While the technology is still a few years out, scientists and AI developers from the Future of Life Institute have called for a ban on such weapons (Future of Life Institute 2015). They fear that these technologies could easily be scaled and used by non-state actors such as terrorists and criminals. Likewise, the NGO *Campaign to Stop Killer Robots* also seeks to create global consensus around restricting the development of these weapons (The Campaign To Stop Killer Robots). It remains to be seen whether political leaders will heed to these grave calls or instead opt for engaging in a dangerous arms race.

III. How Did We Get Here?

Tracing the development of our modern state of dependence on technology and AI could arguably extend back for millennia given the inventive drive of the human species. Yet the uniqueness of our present moment can be seen to emerge from a comparatively recent set of starting points. These come into focus when we view the observations of the preceding section as the confluence of three historical trends or “streams”: *automation, optimization,* and *human sciences*.

III.1. The Stream of Automation

Automation can be regarded as the endpoint of *mechanization*, the alleviation or replacement of human (skilled) labor via the use of machines. Typified by the power loom of the early Industrial Revolution which served both to meet and to increase demand for high-quality textiles, this new automation technology resulted in reduced wages and unemployment for skilled (human) weavers. It also opened up opportunities for low-skill human employment, including a rise in child labor that was

[4] For an in-depth investigative analysis of Russian cyber hackers, we recommend Andy Greenberg’s *Sandworm: A New Era of Cyberwar and the Hunt for the Kremlin's Most Dangerous Hackers.*

often exploitive (Smelser 2011). Comparisons between the Industrial Revolution and modern AI deployment are common (e.g., Morrisse 2017), with AI often being dubbed "The Fourth Industrial Revolution" (e.g., Crameri 2018).

Automation offers perceived advantages to employers over human labor, which include:

- *continuous operation*: being able to operate day and night, and without breaks
- *speed*: being able to work faster than humans
- *consistency* of products: a requirement for supply chains
    - This also implies the ability to easily *scale*: new "workers" need not be trained, rather new machines can be deployed.
- the obviation of "human resources" considerations such as paying benefits, dealing with injury or sickness, or having the "workers" organize as labor unions.

While these features of automation have been traditionally viewed in light of factory manufacturing processes, all of these features are directly mirrored in modern AI-based approaches to a host of applications, including online sales, criminal justice, surveillance, software-as-a-service, automated content moderation, and countless others. Some implications of automation, such as the ability to scale, are now such standard tech industry parlance as to be termed "key buzzwords" (Bridgwater 2020). One major proponent of automation was Henry Ford, whose introduction of the assembly line allowed the scale of automotive production to outstrip all competitors at the time. In addition to introducing means to automate manufacturing processes, Ford strived to maximize their efficiency, using ideas inspired by (and later conducted in consultation with) Frederick Taylor, a major figure in what we are calling the Stream of Optimization.

III.2. The Stream of Optimization

We use the term "optimization" in the sense of maximizing rewards and/or minimizing risks, and include attempts to increase efficiency. It can refer to merely the mathematical or engineering operations itself, or, when applied to increasing scopes of life the drive to optimize can be regarded as an ideology, what Jacques Ellul referred to as "Technique" (Ellul 1964), resulting in the "tyranny of a technical order," a world in which technology exists for its own sake and everything else is secondary to the ultimate goal of efficiency. Driven to its logical conclusion, this drive to optimize efficiency yields outcomes inimical to human flourishing (Burdett 2020). Both the ideological aspects of optimization and their repercussions in the world of business and society can be viewed in terms of the legacy of Frederick W. Taylor, the mechanical engineer who rose to fame as an efficiency consultant to American businesses in the early 20th century (Saval 2014). Taylor's "scientific management" approach of breaking down employee's work processes into a series of small tasks mirrored the design of Henry Ford's assembly plants and included the monitoring and micro-management of these tasks to improve efficiency. Modern employee surveillance systems such as Microsoft's new Productivity Score feature (Hern 2020) are direct descendants of "Taylorism," with the added feature that in many industries human managers of productivity have themselves been replaced by machines (Lecher 2019) -- thus we see another link between optimization and automation.

While the management and manufacturing processes could be optimized by careful interventions of control, there exist events that remain beyond a business's control, constituting *risk*. Studies of probability had existed since the gambling analyses of Renaissance mathematicians, with the *actuarial* *science* use of probability to quantify the risk of death for insurance purposes following shortly thereafter. Yet the data to inform such probability estimates were for many years not easily obtainable. The harvesting of personal data was greatly advanced by Francis Galton, "the Father of Statistics," who appealed to the Institute of Actuaries urging them to avail themselves of opportunities to acquire data on people in order to improve risk assessments (Pearson 1914). At the 1884 World Health Exhibition, Galton pioneered a method of creating massive *datasets* of people (Johnson et al. 1985) by enticing them to participate in activities such as games that revealed details about themselves, even charging them money to do so (Cowan 1972). This served as a direct precursor of the data-harvesting "Facebook games" (Bogost 2018) of the early 2010s. Galton would go on to apply his datasets and analyses to "scientific" methods of law enforcement, such as his fingerprint classification system that survives to this day (Jiang 2009), as well as more dubious and discredited physiognomy studies predicting criminality that see modern misguided applications via more sophisticated methods such as neural networks (Bailey 2016).

Modern ML systems use statistics gleaned from large datasets created by imitating Galton's method of offering users something "for cheap," such as the price of their privacy. Google pioneered this with "free" utilities such as Gmail and Google Docs. Google provides this functionality in exchange for the authors' license to users' text when training various ML systems. It is no surprise that two of the most successful ML research groups are those run by Google and Facebook, who own more data on citizens than Western government-run security organs. It is worth noting the link between statistics and police work advocated by Galton offers an appealing option for resource-strained organizations. From 2005 to 2010, the protagonists of the CBS television show "NUMB3RS" who often made use of statistical "predictive policing" methods were portrayed as heroes, finding hostages before time ran out or tracking down dangerous serial killers. Since 2010, the narrative around predictive policing has shifted dramatically, as it has been demonstrated that such methods reinforce racist patterns of selective enforcement (Noble 2018).

It is in ML that the two streams of automation and optimization merge, *for machine learning consists of casting an automation problem as an optimization problem*. Although Galton combined datasets on humans with statistics to recommend policies, he lacked a model of human cognition or the nuanced insights into behavior that would emerge in the 20th century. Thus a proper account of the trajectory leading to the present state of technology and AI would be incomplete without considering contributions from the human sciences.

III.3. The Stream of Human Sciences

The previous two streams could be regarded as processes of capitalism, but the third stream of AI development derives at least as much from purely academic pursuits of scientists having no commercial intentions as it does from marketing and advertising executives who later applied the scientists' work. The human sciences of behavioral psychology, cognitive science, and social dynamics have contributed significantly to the development, application, and assessment of AI systems. In order to have a machine that performs human-like tasks with results that conform with human expectations, borrowing and modeling neural architectures from biological brains has, in the past 10 years, demonstrated significantly improved gains in model expressiveness and accuracy over symbolic AI approaches.

Modern neural network systems owe their origins to a series of efforts to better understand and model the human brain. The seminal work of McCulloh and Pitts (McCulloch and Pitts 1943) is typically invoked for introducing the first artificial neuron that became known as the "perceptron," yet their work was significantly more than that because they applied the *computational* paradigms of Alan Turing to *networks* of their artificial neurons to describe brain activity.[5] The cross-pollination between neuroscientists and computer scientists has been significant over the ensuing decades, and even as formalized efforts toward "Artificial Intelligence" by the likes of Minsky and collaborators (Minsky and Papert 1969) sought to do away with the popularity of perceptron models in favor of symbolic reasoning for the brain the goal was purely a scientific, not economic one. Along the way, there has been some interesting interplay between the development of purely artificial methods that "work" despite their lack of biological basis versus methods designed to directly mimic biological systems. One example would be the notion of "learning": It wasn't until 7 years after the Perceptron model that a mechanism for learning was proposed by David Hebb (Hebb 1949), and yet "Hebbian learning," has proven generally much less useful for AI than the optimization method known as "backpropagation" (Schmidhuber 2014), despite backpropagation's lack of biological grounding. This has been likened to the way humans developed airplanes that fly with wings inspired by birds and yet the airplanes' wings do not flap, or how submarines "swim" via the use of propellers instead of moving their tails like fish. As neural networks have become increasingly *useful* for tasks in business, government, etc., the goal of mimicking human thought has become increasingly de-emphasized in AI development (Hinton 2014), with the contrast between real and artificial becoming starker, namely that a system can perform tasks *similar* to how humans do without necessarily using processes identical to those of humans.

Besides the design of neural networks, also important are the behavioral psychology studies of "conditioning'' pioneered by Pavlov and later Skinner (Bouton 2020). The notion that neural responses in animals, and by extension humans, can be trained by conditioning them on a series of reinforcements has had widespread applications in education, which have since been extended to training robots in the burgeoning field of "Reinforcement Learning." Such applications have evolved from early game-playing AIs to sophisticated systems for content recommendation, financial trading, and industrial controls (Argerich 2020). Yet the most large-scale application of these behavioral science methods has been with the (often non-consensual) experimentation on humans via "addictive" apps, noteworthy Facebook, who hired behavioral psychologists as consultants for the express purpose of making the app addictive in order to sell more advertising. The idea of "nudging" (Tagliabue et al. 2019) or influencing users without their noticing has become a familiar part of the repertoire of social media influence strategies.

The enterprise of influencing large numbers of people owes a great debt to Edward Bernays, whose *Propaganda* brought ideas from the behavioral psychology of business marketing into the world of politics, and whose strategies and methods have been cited for directly influencing the success of populist political movements including the rise of Naziism and the election of Donald Trump (Jones 2017). A significant passage reads:

[5] For a gripping biography of Pitts and his working relationship with McCulloch, see Amanda Gefter's article, "The Man Who Tried to Redeem the World with Logic," *Nautilus*, Feb. 5, 2015.

> *"The conscious and intelligent manipulation of the organized habits and opinions of the masses is an important element in democratic society. Those who manipulate this unseen mechanism of society constitute an invisible government which is the true ruling power of our country. We are governed, our minds are molded, our tastes formed, and our ideas suggested, largely by men we have never heard of…. It is they who pull the wires that control the public mind."* (Bernays 1928, p. 10)

The point of including this quote is not to promote conspiracy theory, but rather to contextualize it to the power of large-scale social media platforms in use today. As we will see in the following sub-section, this enterprise of popular influence, when automated and scaled, and optimized by ML, can be employed to serve as an engine of change in world affairs.

III.4 The Confluence of the Three Streams

We now have automated, scaled global information platforms, designed to maximize user engagement by exploiting insights gained from the behavioral sciences, optimized by ever-more sophisticated models mimicking human cognitive processes, with feedback loops via the data they harvest during user engagement, which individualize/personalize the content seen and can be used to influence public opinion in ways previously only hoped for. An example of such an application was described in Section II, namely the use of Facebook user data by Cambridge Analytica to influence elections in Trinidad and Tobago, the USA, and the UK. Although the documentary's claims are in parts exaggerated as a tale of techno-determinism (Lynch et al. 2018), the deliberate use of Facebook as a weapon of (personalized) algorithm-driven propaganda serves as a significant techo-cultural milestone. A further *unintended* effect of social media platforms on political life is the emergence of "echo chambers" or "filter bubbles" (Pariser 2011) created by recommendation algorithms which show users content expressing views they are likely to resonate with, with resultant growing polarization in society. Similar unintended polarizing effects were exposed in YouTube's video recommendation (i.e., user engagement optimization) system by former Google Brain engineer Gilliame Chalot, who pointed out the algorithms' tendency to recommend radical or inflammatory content (Nicas 2018), further driving viewers from areas of common consensus. This suggests an important question: What other "unintended consequences" are likely to emerge as results of automated algorithmic systems designed to optimize users' data-producing behavior? We suspect we are only seeing the beginning of such occurrences; as they are linked to ML algorithms' ability to learn from user data, the role of user data will have a dramatic impact on the directions such developments will take. We next explore regulatory patterns for user data.

IV. Where Might We Be Headed?

As AI systems learn primarily from data, our algorithmic future hinges upon the vital question of data ownership. Techno-capitalists in Silicon Valley believe data belongs to the organizations that collect and store it (Iffergan 2018). Party leaders in China believe data belongs to government entities who can then use them to better manage society (Nussipov 2020a). Other thought leaders in Europe and other continents want to return data ownership to the individual. They believe an equitable future is most likely if we first democratize ownership ensuring privacy and oversight of its use (Nussipov 2020b). The next decades will see the competition between these three main models for data play out in the geopolitical theater. The future will be a mixture of the three as they are replicated around the globe setting the contextual rails upon which algorithms will transform and re-orient societies. In the next sessions, we outline them separately looking at their implications for ethics, political systems, economies, and the environment.

IV.1 The Techno-Capitalist Dream and the Googlization of the World

A techno-capitalist scenario will be driven by experimentation and market forces to sort out the winners. If the stock market is a good indicator of future performance, the FAAMG (Facebook, Amazon, Apple, Microsoft, and Google) group are poised to dominate the business landscape extending into diverse industries from transportation to healthcare.[6] As of 2020, four of these companies have crossed the impressive threshold of the trillion dollar mark in valuation (Winck 2020), one has already reached double that mark (The Economist 2020). This is an unprecedented time in history where multinational companies' value rivals the GDP of most countries in the world.

Their growth and influence are not limited to financial means but also capture the imagination of billions in the world with their vision of the future. Their utopia rests on the belief that all problems have a technological solution. Progress comes through the entrepreneur who creates products people don't even know they need. AI is the means through which this dream is accomplished. If they have their way, AI development will come through bold experimentation. In this scenario, AI continues to flourish through business enterprises that beat out competition by offering the most compelling products or most convenient services for the lowest price. In this scenario, AI is commodified and controlled by the winning organizations that best incorporate it into their operations. Consumers benefit from cheaper products and better services. Yet, workers see their rights and livelihood increasingly diminished through massive inequality as tech companies yield more political power to further their own interests.

The centralization of income, resources, and jobs around large technological conglomerates creates a global elite of highly-skilled workers who can fill the jobs created by the growing companies. Those are the techno-skills-haves. Conversely, those unable to join the ranks of multinational tech companies or the business ecosystems that sustain them face considerable uncertainty in their job prospects. The problem is not that AI replaces human workers but that it irreversibly changes the nature of jobs. It ushers in a new economy that cannibalizes the old, creating new opportunities for those with the right skills but making employment scarce to those who lack those skills. For the latter group, the gig economy becomes the norm where workers have flexibility but little protection or stability. Those are the techno-skills-have-nots.

In this scenario, data is the sole property of the organizations that collect it and the Internet is fully funded by data insights that businesses will pay for. Algorithms are optimized for profit with little consideration for other goals such as human flourishing or environmental sustainability. Instead, technological applications emerge primarily to meet market needs which may or may not align with the priorities of a warming planet. In short, this scenario means an abundance of sophisticated gadgets but fewer breakthroughs in science and or humanitarian work. It is a world of technological products as

[6] Outside of the US, one could include Alibaba, Baidu and Tencent. Netflix is often included in this list which is at times referred to as FANG.

opposed to solutions to global problems. At its worst, it would lead us to the world portrayed in Pixar animated movie *Wall-E*, where humans are forced to leave a trash-saturated and lifeless earth to find another planet.

IV.2 The People's Republic of Data and the Technocratic State

The last 40 years have witnessed the meteoric rise of China to the global geopolitical stage. In a few decades, the Asian giant went from regional player to world superpower status. Its economy is expected to overtake the United States by as early as 2024 (Bucholz 2020). They hope to do so in part by establishing global dominance in AI technologies. The turning point for that decision came in March 2016 when Google DeepMind's AlphaGo bested Lee Sedol in the game of Go, a match watched live by over 280 million Chinese (Schiavenza 2018). In the following year, the Chinese government released a report outlining a strategy to become the leading AI power by 2030 (Webster et al. 2017). Chinese leadership in this area opens the path for an alternative scenario of the future of AI from the one envisioned by Silicon Valley. In this future, the state owns the data and coordinates the private and public sectors to implement AI across industries and infrastructure projects.

What would that look like in practical terms? One sharp contrast is in the area of facial recognition and surveillance. In a regime where concepts of privacy are more fluid, surveillance technology becomes more effective. In 2018, Chinese police identified and caught a most-wanted criminal via surveillance cameras that spotted him from a crowd of 60,000 concert goers (BBC News 2018)! This impressive feat is only possible because China already counts on a vast infrastructure of CCTV surveillance cameras. In this case, algorithms can search through thousands of faces in a short amount of time allowing law enforcement to act quickly. While this method would raise eyebrows in the west, it may be well received in the developing world where crime and corruption are a chronic problem

Another example of how the Chinese data-centralized scenario differs is in the development of a social credit system (Persson et al. 2015). This Chinese innovation expands on the idea of a credit score to a reputational score that includes additional measures of trustworthiness. The idea is to quantify a citizen's deeds and misdeeds in order to incentivize, through punishment or rewards, preferred social behaviors. Punishment can include being denied an airline ticket or barring a child admittance to prestigious private schools and rewards can mean shorter lines in hospitals and possibly better prospects for landing a job.[7]

A future where this scenario is prevalent would see an increasing centralization of data under government entities across the globe. This could yield significant efficiencies and improvements in public services such as smart infrastructure, speedier justice systems, and more robust law enforcement. It would also see increased behavior modification through reputational systems and other technological nudges. Here we see technology as a primary and intentional tool for social engineering and accomplishing national goals. On the positive side, we may see improvements in tackling intractable social problems, building smart cities, and possibly curbing corruption and waste. Hence, government centralized data can unleash algorithmic benefits to a larger share of society. However, it will most likely

[7] Science fiction offers a dystopian view of how social credit can go wrong. British show *Black Mirror*, Nosedive episode, portrays how a woman's life quickly unravels when she makes a mistake that negatively impacts her social credit.

lead to a decrease in individual freedoms and privacy. At its worst, it can lead to Orwellian state control where a totalitarian government regulates every aspect of its citizen's lives. It would be especially detrimental for minorities such as the example of Uighur Muslims in China shows (Mozur 2019). If in the first scenario we are at the mercy of profit-seeking organizations, this one places our fate in the benevolence of governmental bureaucracies.

IV.3 The Democratization of Data for a Shared Future

The third alternative seeks to build a world where data is a shared resource managed by an engaged civic society. Outlines of this scenario are starting to emerge in the European Union. Its foundations are built on user-owned data and transparent algorithms along with vigorous regulation to curb data misuse by government or corporations. In this scenario, data belongs to individuals ensuring that the wealth mined is shared more broadly across all levels of society.

The seeds of this vision began with the free software movement in the late 1980s (Free Software Foundation 2005). In a time when Microsoft was beginning to build its empire based on commercial closed-code, the free software foundation (GNU) ushered in a powerful alternative where programmers shared the fruits of their labor *gratis*. By the late 1990s, the movement would change its name to open-source as a way to gain greater adoption in the corporate world where the "free" label often raises suspicion (Opensource.org 2018). The consolidation of the Internet as a global agent for connection further reinforced the idea that programming knowledge should be a free communal endeavor. In the age of big data, this is translating into a movement for open data where large datasets are made available to the public for free.[8]

The collaboration is not limited to data but is now expanding into the algorithms where volunteer communities are emerging to regulate their use. The city of Amsterdam, for example, recently created a registry that lists all the algorithms that the city uses to provide public services. The registry lists the algorithms and offers plain explanations of how they work, their potential risks, and biases they may have. Citizens can not only get a better understanding of how the city government employs algorithms but can also provide feedback. Public registries as these represent an intentional move towards human-centered algorithm development and oversight.

This vision is enshrined in the recently adopted GDPR (European Parliament 2016), namely, the European Union regulatory blueprint for the use of personal data. It defines data protection as a fundamental right, therefore envisioning data privacy as a human right. In practice, that means that the individual has full autonomy to know and decide on what is being done with their information. As such, the EU seeks to foster an environment where innovation can still flourish while individual privacy is preserved. To date, it is the most robust piece of legislation in the area and in store to be replicated in other areas of the world. In January of 2020, California implemented its own version, which while echoing some of GDPR's principles, stopped short of empowering the individual to fully restrict a company's use of their data (Jehl et al. 2018).

Another facet of this vision is the democratization of tech skills. If the corporate-driven model creates an elite of highly skilled workers, open AI seeks to make these skills readily available to the

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[8] For examples consult https://data.worldbank.org, https://sparcopen.org/open-data, and the US government's repository for free datasets https://www.data.gov

masses, especially to under-represented groups such as Latinx, African-Americans, and women. A great example is the OpenMined community who seek to teach individuals from all backgrounds how to build AI models that also preserve data privacy through encryption and federated learning (OpenMined 2019). Furthermore, a cottage industry of coding academies that offer bootcamps and micro-degrees are popping up all over the world providing more affordable options for those seeking to upskill for tech jobs. Early reports, however, do not show an expansion in diversity as their student composition still mirrors the ethnic and gender underrepresentation in the industry (Eggleston, 2017). With that said, several non-profit initiatives are trying to change this trend by encouraging adolescents and young adults from under-represented groups to study STEM (Science, Technology, Engineering, and Math) subjects (Walsh 2020).

The success of this vision could fundamentally change how technology is developed and used in the world. At its best, a diverse tech workforce along with data and algorithms monitored by civic society should yield a more human-centric technology. Furthermore, global volunteer alliances can engage in tackling difficult global problems through cooperation and knowledge sharing. Certainly, industry and government would still play a role as non-profit NGOs are limited in their reach and face challenges in becoming sustainable over the long haul. At its worst, such open environments could promote digital anarchy where malicious actors use technology for their own gain. In the absence of greater government control and industry standards, groups like Anonymous could multiply and wreak havoc in economies all over the globe where vigilante groups enact many forms of mob justice (Beran 2020). In this scenario, we are at the mercy of our global collective to regulate our most insidious impulses.

V. Summary

Technology and Artificial Intelligence, both today and in the near future, are dominated by automated algorithms that combine optimization with models based on the human brain to learn, predict, and even influence the large-scale behavior of human users. Such applications can be understood to be outgrowths of historical trends in industry and academia, yet have far-reaching and even unintended consequences for social and political life around the world. Countries in different parts of the world take different regulatory views for the role and protection of user data, and this will in turn determine the course of development for technology and AI in the near future.

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