How Can We Prepare for the Future of Artificial Intelligence?

A Research Paper Submitted to the Department of Engineering and Society

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia – Charlottesville, Virginia

In partial Fulfillment of the Requirements for the Degree
Bachelor of Science, School of Engineering

By

John Perez

April 27th, 2020

On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

Approved: _____ Date _____
John Perez

Approved: _____ Date _____
Richard D Jacques, Department of Engineering & Society

Introduction

First Law: A robot may not injure a human being or, through inaction, allow a human being to come to harm.
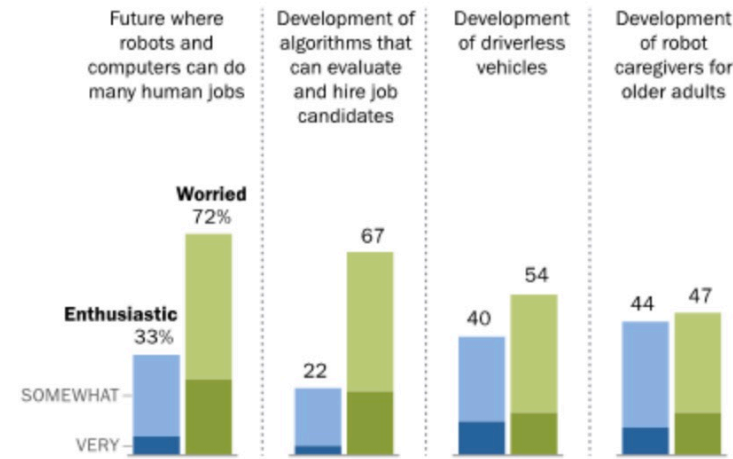
Second Law: A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.

Third Law: A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.

Isaac Asimov introduced his famous Three Laws of Robotics in one of the short stories from his collection "I, Robot" (1950) in which a robot finds it impossible to obey the laws simultaneously, resulting in a loop of repetitive behavior. With this publication Asimov inspired engineers to ponder how the human mind might work. Sixty years later, we have a humanoid robot that is capable of seeing, making facial expressions, and communicating through AI – she is also named Sophia and has been granted citizenship in Saudi Arabia (Sturco, 2018). How is artificial intelligence being regulated to prevent misuse? As robots become smarter with advances in technology, will they make our lives easier or more difficult? Since any technology is prone to misuse, the future of artificial intelligence is on us as a society (Marr, 2019) though Americans are twice as likely (72%) to express worry than enthusiasm (33%) about a future in which robots and computers are capable of doing many jobs that are currently done by humans (Smith & Anderson, 2017).

More worry than optimism about potential developments in automation

% of U.S. adults who say they are enthusiastic or worried about…

Future where robots and computers can do many human jobs | Development of algorithms that can evaluate and hire job candidates | Development of driverless vehicles | Development of robot caregivers for older adults

Worried 72%

Enthusiastic 33%

67

54

40   47
44

22

SOMEWHAT

VERY

Note: Respondents who did not give an answer are not shown.
Source: Survey conducted May 1-15, 2017.
"Automation in Everyday Life"

PEW RESEARCH CENTER

Figure 1: This Graphic shows that more American adults are worried than enthusiastic about artificial intelligence permeating their everyday lives (Smith & Anderson, 2017).

This paper will use the Social Construction of Technology (SCOT) to analyze the relationship between society and artificial intelligence. I chose this STS theory because artificial intelligence in theory long-precedes artificial intelligence in practice. As a result of this ordering, the technology as we know it has been mostly a result of social construction. Engineers were influenced by social factors like Asimov's Three Laws when creating artificial intelligence. The advantage of this framework is the ability to analyze and "distinguish cause and effect," unlike something like Actor Network Theory (Klein & Kleinman 2002). By effectively eliminating the variable of technology's influence on society, we can clearly see how society has influenced technology. The problem with SCOT is that different groups in different societies construct different problems, leading to different designs (Russell 1986). Realistically, any corporation could be a stakeholder because the proliferation of artificial intelligence could affect every

corner of industry. From the stock exchange to biomedical sciences to agriculture to art to the

justice system, if artificial intelligence has not already found a place in these fields, it surely will

in the future. The potential pervasiveness of artificial intelligence can be worrying. However, any

technology is susceptible to misuse. Since artificial intelligence is socially constructed, it is our

responsibility as a society to determine what research within the field should be prioritized, how

government policies need to change to account for artificial intelligence, and what strategies the

artificial intelligence community needs to pursue in order to maximize benefits and minimize

societal risk (Comets Labs Research Team, 2016). Relevant artifacts include training models for

machine learning algorithms, public policies regulating artificial intelligence, and limitations of

existing computer hardware. The most important of these artifacts is arguably training models for

machine learning algorithms because these are the most susceptible to misuse. It is vital that data

scientists recognize their moral responsibility to train machine learning models with unbiased

data. Only then can we digress from innate human biases rather than perpetuate them. This

research is important because many people wrongfully fear artificial intelligence as a result of

social media. The truth is that artificial intelligence is an incredibly powerful tool and because it

is still a relatively new technology, there is minimal infrastructure to handle it. We, as a society,

must push for regulation and policies to accommodate artificial intelligence so that we are

prepared to harness its power for good while minimizing damages and misuse.

Part I: Should We Be Nervous about Artificial Intelligence?

To answer this question, I will look at how specific sectors of industry have changed as a

result of implementing forms of artificial intelligence into their practices. In the automotive

industry, "autonomous vehicles have the potential to save time, limit energy consumption, and

dramatically reduce the more than 1.25 million deaths that are attributed to road traffic accidents

each year" (Artificial intelligence, n.d.). As for the legal sector, we see a similar phenomenon occurring. According to a journal published in the Cambridge Journal of Regions, Economy and Society, artificial intelligence has "the potential to change the production and consumption of legal services and even the nature of law itself" (Brooks & Gherhes & Vorley, 2020), leading to "greater efficiency, openness, transparency, and personalisation of services" within the industry. Since the automotive and legal fields believe there are massive benefits to adopting artificial intelligence, let's see how the healthcare sector has already benefitted from AI. According to PricewaterhouseCooper's article, AI has improved training, research, end of life care, treatment, keeping well, early detection, diagnosis, and decicison making (Wilson, n.d.). One specific way that AI has contributed to the early detection in healthcare is as follows:

> AI is already being used to detect diseases, such as cancer, more accurately and in their early stages. According to the American Cancer Society, a high proportion of mammograms yield false results, leading to 1 in 2 healthy women being told they have cancer. The use of AI is enabling review and translation of mammograms 30 times faster with 99% accuracy, reducing the need for unnecessary biopsies (Wilson, n.d.).

From these three examples, we can see that artificial intelligence can dramatically improve several different sectors of industry from the automotive industry to the legal sector to the healthcare industry and everything in between. With this in mind, there is no need to be nervous about artificial intelligence becoming more pervasive in society.

Won't Artificial Intelligence Replace Human Workers?

The most immediate concern for many is that AI-enabled systems will replace worker across a wide variety of sectors of industry. Though there are many strong opinions regarding AI especially in the context of jobs and job security. As more AI-enabled systems enter the

workplace, it is becoming more and more clear that AI is not job killer, rather a job *category* killer. Past waves of new technologies from the cotton loom of the early industrial revolution to the computers of the modern era did not destroy jobs leaving the economy in shambles. Rather, employment shifted from one place to another and entirely new categories were created. Since history tends to repeat itself, we can and should expect the same thing to occur with artificial intelligence. Research and experience shows that AI will inevitably replace entire categories of work. Industries to be wary of in the future include "transportation, retail, government, professional services employment, and customer service" (Walch, 2019).

Part 2: Artificial Intelligence Through the Lens of the Social Construction of Technology

The Social Construction of Technology framework proposes the idea that technology does not determine human action, rather human action shapes technology. Since the idea of artificial intelligence long predates its invention, it is clear to see that social forces has motivated the versions of AI we see today. A few examples include the *Star Trek* video-enabled wristwatch communicators inspiring the modern day smartwatch, the driverless car from the TV series *Knight Rider* inspiring the autonomous vehicles of the Tesla company, the floating touch computer displays from retro sci-fi movies directly inspiring the touchscreens we interact with on a daily basis, and the human-like robots of *Blade Runner* inspiring the design of Sophia, the robot citizen of Saudi Arabia.
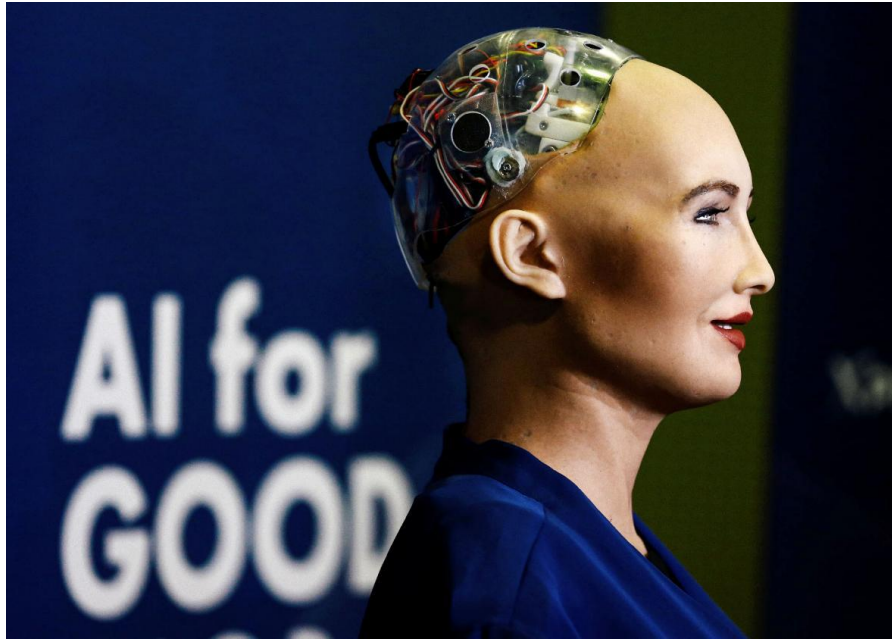
Figure 2: Sophia was granted citizenship in Saudi Arabia in 2017, becoming the first ever robot with a nationality (Sturco, 2018).

From these examples of science fiction directly influencing the direction we take advancements in artificial intelligence, the SCOT is certainly a valid framework to analyze and predict its growth in society. Since artificial intelligence is largely socially constructed, the responsibility falls on us to determine what direction we take it. Artificial intelligence is an incredibly powerful tool and since it is still an emerging technology, there is not much infrastructure in place to handle it. We as a society must push for regulation and policies to accommodate artificial intelligence so that we are prepared to harness its power for good while minimizing damages and misuse.

Part 3: How Can We Prepare for Artificial Intelligence as it Becomes More Pervasive?

Politicians worldwide have been drafting plans and ideas to make the most of advances in artificial intelligence. At the end of the Obama administration, they released a report that unfortunately did not include any funding but made it clear that AI should be a key focus of government strategy in the near future (Knight, 2018). The Trump administration has completely

abandoned this vision with no intention of devising any plan to handle AI. Rather, they have decided that there is no need to facilitate the technology whatsoever believing that minimal government interference is the best way to make sure the technology flourishes. This seems like a catastrophic mistake. By ignoring this technological revolution in the making, the US might never make the most of an opportunity to reboot its economy and get a jump on wage-growth and job creation.

"Funding AI research is the biggest priority, says Jason Furman, one of Obama's top economic advisors and author of the 2016 AI report" (Knight, 2018). According to Furman, basic research requires government backing and advances made privately are not guaranteed to benefit the country as a whole. It is especially important to promote AI research because it could provide an economic boost leasing to wage growth and new employment opportunities. In the past, "core AI breakthroughs have their roots in academia" (Knight, 2018) pointing out that the universities should be the primary recipients of public research funding.

Another factor we must prepare for is job losses. While AI can stimulate economic growth, it may also wipe out entire occupation classes, transform the nature of work within certain sectors, and exacerbate economic inequality. The government might prepare for this in various ways. This might come in the form of exploring way to find training and employment opportunities for people who have lost their jobs to automated systems.

We as a society can further prepare by emphasizing education. Tess Posner, leader of the nonprofit AI4All says that "there is not only a talent crisis in AI; there is a diversity crisis, and that is problematic" (Knight, 2018). AI is such an important technology that there should be a nationwide focus on it by launching university AI programs or providing funding to doctoral students at top universities.

Furthermore, there should be more regulation on public policy. Whether it is accidents involving autonomous vehicles or algorithmic bias and fairness in predicting the likelihood of criminals reoffending, there are limits to how far you can go with existing regulations. And these cases are only the tip of the iceberg. In time, more of these situations will reveal themselves so it is vital that we prepare for way that artificial intelligence can be misused by criminals, terrorists, or foreign governments.

Most importantly, the government must continue to understand artificial intelligence and what it is capable of. Since AI is such a complex field that is continually developing, it is especially important that experts brief government officials and policymakers. Without a technical understanding of AI it would be near impossible to design effective policy.

Conclusion

Artificial intelligence has already begun to revolutionize the world we live in. Since AI is a socially constructed technology, we can determine the path that the technology takes. Though we have seen countless examples of misuse is media like *2001: A Space Odyssey*, The *Matrix* Trilogy, and the *Terminator* series, there is little reason to fear artificial intelligence so long as we prepare for the imminent proliferation of the technology.

Here are some of the key preparations that must be made if we are to maximize the benefits of the powerful technology and minimizes risk. We must fund research to ensure that we are in a position to take advantage of the benefits that AI can provide like an economic boost and new job opportunities. We must brace ourselves for the job market to shift as automated systems replace old jobs and create entirely new fields. Education must also be a priority so that the entire nation is equipped to deal with artificial intelligence and possibly even grow the field further. Public policy should also be augmented to handle automated systems, prevent misuse and dispel

ambiguity in responsibility as artificial intelligence becomes more and more commonplace. And most importantly, we must continue to understand artificial intelligence. This is a more daunting of a task than it seems. Artificial intelligence is incredibly complex and rapidly changing despite being a relatively new technology. As AI becomes more pervasive in society, the only way that we can make the most of such a powerful tool while minimizing errors is by continuing to understand it and prepare for it in every way possible.

References

Artificial intelligence is changing these 9 industries. (n.d.). Retrieved from

https://www.businessinsider.com/sc/artificial-intelligence-companies?IR=T

Asimov, I. (1950). *I, Robot*. Street & Smith.

Brooks, C., Gherhes, C., & Vorley, T. (2020). Artificial intelligence in the legal sector: pressures

and challenges of transformation. *Cambridge Journal of Regions, Economy and Society*.

Retrieved from https://academic.oup.com/cjres/advance-

article/doi/10.1093/cjres/rsz026/5716343

Comet Labs Research Team. (2016, January 19). Algorithms Among Us - Societal Impacts of

Machine Learning (NIPS 2015, Day 4). Retrieved from

https://medium.com/@comet_labs/algorithms-among-us-societal-impacts-of-machine-

learning-nips-2015-day-4-3cbd9a82cb38.

Klein, H. K., & Kleinman, D. L. (2002). The Social Construction of Technology: Structural

Considerations. Retrieved from

https://pdfs.semanticscholar.org/4c17/4dc2d6a6a4f6b8a75df2bc255b287ba2acaa.pdf.

Knight, W. (2018, April 2). Here's how the US needs to prepare for the age of artificial

intelligence. Retrieved from

https://www.technologyreview.com/2018/04/06/240935/heres-how-the-us-needs-to-

prepare-for-the-age-of-artificial-intelligence/

Marr, B. (2019, March 14). Is Artificial Intelligence Dangerous? 6 AI Risks Everyone Should

Know About. Retrieved from https://www.forbes.com/sites/bernardmarr/2018/11/19/is-

artificial-intelligence-dangerous-6-ai-risks-everyone-should-know-

about/#74010deb2404.

Russell, S. (1986). The Social Construction of Artefacts: a Response to Pinch and Bijker

    Retrieved from https://journals.sagepub.com/doi/10.1177/0306312786016002008.

Sturco, G. D. (2018, May 18). Meet Sophia, the Robot That Looks Almost Human.

    Retrieved from https://www.nationalgeographic.com/photography/proof/2018/05/sophia-

    robot-artificial-intelligence-science/.

Walch, K. (2019, December 28). Ethical Concerns of AI. Retrieved from

    https://www.forbes.com/sites/cognitiveworld/2020/12/29/ethical-concerns-of-

    ai/#311341a23a8f

Wilson, T. (n.d.). No longer science fiction, AI and robotics are transforming healthcare.

    Retrieved from https://www.pwc.com/gx/en/industries/healthcare/publications/ai-

    robotics-new-health/transforming-healthcare.html