The Birth of Artificial Intelligence and its Baby Steps

Nataly Melendez

University of California, Merced

Keywords: Technology, future, autonomous, artificial intelligence

Abstract

We are living in the era of technology; it is hard not to see it in our everyday lives. Ray Kurzweil and Michio Kaku, prominent figures in the field of artificial intelligence, affirm that the role it will play in the present and future will be a positive one. Developments and innovations such as autonomous cars, advanced prosthetic limbs, predator drones, etc. aim to assist humans in adequate situations. Artificial intelligence is often depicted as antagonistic, however, the testimonies of individuals and organizations such as LAWS, allege otherwise.

Introduction

Technology as we know it is barely starting to evolve. Prior to the eighteenth century, nearly every job required some type of labor. When pondering the idea of a job, manual labor could not be subtracted from the equation; it was a guaranteed factor. Now, with the advancement of artificial intelligence, the lives of Americans have become much easier. Fast-moving improvements in artificial intelligence are setting the stage for a new, upgraded future that is bound to benefit society. Artificial intelligence will help the disabled live a normal life by providing them with body parts or senses they lack, assist humans in war, and facilitate jobs while bringing new ones to fruition. Ray Kurzweil and Michio Kaku affirm that artificial intelligence will positively affect society; it will become a friendly resource that humans will turn to and not the common misconception of an antagonist robot on a mission to destroy the human race.

Through the Lens of a Futurist

In 1965, a seventeen-year-old boy first exhibited his intelligence on the live TV show, "I've Got a Secret", in which he aired that he had designed and built an electronic computer. This boy was Ray Kurzweil, one of the greatest entrepreneurs, who is considered one of the world's leading inventors, thinkers, and futurists, with a 30-year track record of accurate predictions" (Kurzweil Accelerating Intelligence). Among his creations are, "the first CCD flatbed scanner, the first omni-font optical character recognition, the first print-to-speech reading machine for the blind, the first text-to-speech synthesizer, the first music synthesizer capable of recreating the grand piano and other orchestral instruments, and the first commercially marketed large-vocabulary speech recognition" (Kurzweil Accelerating Intelligence). Kurzweil

has attained credibility through these far-fetched ideas because he proves to be right most of the time, “in the ‘90s, he made 147 predictions for 2009. In 2010, he reviewed his predictions, 86% of which were correct” (Money CNN). Kurzweil believes that the power of technology will progress to the point in which humans can no longer comprehend it. The Turing Test is a test that only a robot can undergo. It is when a robot demonstrates human-like conversations and intelligent behavior to the point in which a human cannot even identify he/she is speaking to a robot, “If it can fool the judge 30% of the time, it passes the Turing test” (Shyamasundar). Kurzweil believes that the test will be passed by robots in 2029. To many, the notion of robots becoming more intelligent than humans at one point in time is scary, however, Kurzweil has an optimistic perception towards the situation. He admits that there are downfalls, and he has analyzed them but believes the pros outweigh the cons, “he believes technology will augment us. Make us better, smarter, fitter… He is unimpressed by Google Glass because he doesn’t want any technological filter between us and reality. He just wants reality to be that much better” (Cadwalladr). By 2045, he predicts that a computer will outsmart and overpower all the human brains. Because it is a process that will perfect over time, the advancement of artificial intelligence to the point of consciousness will not be a surprise. Robots will not be computers one day and just snap into consciousness, wanting to take over the world the next day. Kurzweil’s ideas would seem radical, much like Galileo’s theories were, but at this point in time, with the types of technologies that have been released and those that are yet to come, his notions are anticipated. It is not a matter of ‘if’ it will happen, it is now a matter of ‘when’ it will happen.

Piecing the Human Puzzle Back Together

Many of the day-to-day products humans use are tech-based. The basic technologies, such as phones, cars, TVs, game systems etc. are minor compared to the future advancements. The possibilities of future technologies are becoming limitless. Artificial intelligence possesses the power to better the lives of people permanently. Nigel Ackland, a father and an owner of the "world's most advanced prosthetic limb", suffered an accident at his job forcing him to have his arm amputated (YouTube). This 'Terminator arm' has allowed him to carry on with his life by giving him back an essential body part. This type of prosthetic differs from the rest, "The new bebionic3 myoelectric hand, which is also made from aluminum and alloy knuckles, moves like a real human limb by responding to Nigel's muscle twitches" (Hodgekiss). This type of artificial intelligence is controlled by thought. The effect that the arm has had on Nigel and his son has been a positive one, "Incredibly, the robotic arm is so sensitive it means the father-of-one can touch type on a computer keyboard, peel vegetables, and even dress himself for the first time in six years" (Hodgekiss). He no longer has to rely on anyone; his 'terminator arm' ensures him the ability to complete simple or difficult tasks for him and his son, which is huge for a single father. However, there have also been advancements in prosthetics for the lower limbs. Michael Golfarb, "the H. Fort Flowers Professor of Mechanical Engineering, and his colleagues at Vanderbilt's University Center for Intelligent Mechatronics… developed the first robotic prosthesis with both powered knee and ankle joints" (Salisbury). Figure 1 below displays the robotic leg:

Figure 1. The First Robotic Prosthesis. Salisbury, David. "Robotic Advances Promises Artificial Legs That Emulate Healthy Limbs." *Research News at Vanderbilt*. N.p., 7 Nov. 2013. Web. 13 Nov. 2015. <http://news.vanderbilt.edu/2013/11/robotic-legs-healthy-limbs/>.

The prosthetic leg is also controlled by thought. Golfarb and his team have devised a plan that ensures this innovation to be helpful and a solution addressing the grand challenge of disability:

> "The electric motors play the role of muscles. The batteries store enough power so the robot legs can operate for a full day on a single charge. The sensors serve the function of the nerves in the peripheral nervous system, providing vital information such as the angle between the thigh and lower leg and the force being exerted on the bottom of the foot, etc. The microprocessor provides the coordination function normally provided by the central nervous system. And, in the most advanced systems, a neural interface enhances integration with the brain" (Salisbury).

Because it does rely on thought, it is connected to the central nervous system. Invasiveness can be a problem, nevertheless, the team is still working towards figuring out the best method to stray from being intrusive; people need their privacy and that is understandable. As opposed to

a passive leg, the prostheses moves like a natural leg. This decreases rates of injuries that amputees are exposed to if they were to settle for a passive leg; they are more prone to fall with that. Although these injuries are seen more with young patients due to the fact that they cannot control the need to be active, elder patients also suffer from these injuries. They feel the effect even more because of their fragile bodies. The prostheses, "both walking and standing, can compensate better for uneven ground. Active responses can be programmed into the robotic leg that helps users recover from stumbles" (Salisbury). In figure 2 below, Michael Golfarb walks with Craig Hutto, a sixteen-year-old who lost his leg in a shark attack. The prosthetic leg gave this teenager his leg back. It gave him something close to normality.

Figure 2. Michael Golfarb and Craig Hutto. Brasher, Joan. "Out of the Deep." *Vanderbilt MyVU*. N.p., 1 Aug. 2011. Web. 14 Nov. 2015. <http://news.vanderbilt.edu/2011/08/out-of-the-deep-hutto/>.

Artificial intelligence, in the sense of prosthetics, has aided those that have suffered tragic and traumatizing accidents. It has given them a second chance to live their lives as natural as

possible. There is still some improvements and steps that need to be made, "Before these prosthetic limbs can become viable products, clinicians will need additional training in order to prescribe prostheses" (Robotic Advances Promise Artificial Legs that Emulate Healthy Limbs). Artificial intelligence will be getting the job done as well as training robots and humans to succeed in their current and new jobs.

Like A Good Friend, AI is There

Artificial intelligence is often perceived as the soon-to-be cause of mankind's downfall. As the creators of this technology, humans will instill a friendly mindset into the system of these robots. Michio Kaku, in his book, *Physics of the Future*, argues that friendly AI will live up to the title given by Kaku himself: friendly. He assures that artificial intelligence will not suddenly turn their backs on the creators, they will be there to help in any field that humans deem necessary. If AI shows even the slightest signs pointing to dangerous behavior, there will be a voice command that will shut them off immediately. Ultimately, they will only be controlled by humans. There will also be robots designed to regulate other robots, "these robot hunters will be specifically designed to have superior speed, strength, and coordination in order to capture errant robots. They will be designed to understand the weak points of any robotic system…" (Kaku 119). Although it is true that many of AI's advancements are happening in the United States, Japan does not fall behind, they too are implementing friendly AI into their society. Artificial intelligence is developing and bettering, it will be the good guy because, "more and more funding for robots will come from the civilian commercial sector, especially from Japan, where robots are designed to help rather than destroy" (Kaku 121). Despite the contrary, for military purposes, robots will be used to kill the enemy. Because the military is the major funder of artificial intelligence, precautions are and must continue to be taken. There is the chance of a

disastrous situation occurring where robots lose sight of who the real enemy is, "Predator drone aircraft, for example, are run by remote control, so there are humans constantly directing their movements, but one day these drones may be autonomous, able to select and take out their own targets at will" (Kaku 121). Artificial intelligence continues to improve and these conflicts will be solved in due time; technology is making its mark on the world and the people of this generation are only witnessing its baby steps.

AI: Job Thief or Job Generator?

In a world that relies heavily on technology, a future with robots taking all the jobs isn't an insane prediction. Machines do not need to be paid like humans, they work more efficiently, there's many things robots can do that humans cannot, "Business people in a free economy will then use these machines in preference to humans because this substitution will lower the cost of production – and simultaneously raise the quality – of goods and services" (Nilsson 14). However, robots will not replace humans completely, they will be working alongside them. Because humans created and programmed these machines, they will also need to be trained. Robots are designed to be smart but if they're anticipated to be smarter than humans, they need to experience things to learn things, just like humans. Artificial intelligence and humans will be working collaboratively to better society. After all, robots cannot make or train themselves, they have to originate from somewhere, or in this case, someone. Improvements in AI will open doors for opportunities, "automation will spur the growth of many new jobs – including some entirely new job categories" (Metz). In a sense, artificial intelligence will assume the responsibility of handling the hard labor. Because these robots will be a part of humans' everyday lives, they'll be everywhere. Jobs will be generated and society will not suffer a drastic

unemployment cut or economical downfall. Artificial intelligence will bring a new world to fruition.

A Positive Future

The artificial intelligence package comes with treats that will be enjoyed by society. In the moment, technology is at a good place. We have impressive technologies that serve as luxuries, however, the future holds a world where all types of technology will be ordinary. Artificial intelligence is bettering society day by day in various aspects, "The continued opportunity to alleviate human distress is one important motivation for continuing technological advancement" (Kurzweil). Futurists such as Ray Kurzweil and Michio Kaku believe that our generation will live to witness the evolution of artificial intelligence from good too great to appalling. Upcoming technologies such as the prosthetic limbs, war-bots, and friendly robots are only a few of the AI systems that will revolutionize society and the human race. We've come a long way technological wise but there is far more road that needs to be covered.

The Ethics Underneath the Pretty Surface

Artificial intelligence flourished at birth. Through the eyes of Ray Kurzweil, one of the world's leading inventors, thinkers and futurists, as well as Michio Kaku, theoretical physicist, futurist and popularizer of science, AI is scheduled to have a positive effect on society. The purpose of AI is to serve humans by facilitating our lives as much as possible. Sooner than later, artificial intelligence will be able to replace an amputee with an advanced prosthetic arm that is controlled by thought and assist humans in war; they will also generate jobs. The future sounds great, nevertheless, the ethics underlying these pros must also be addressed. There are always potential problems that could arise. Artificial intelligence is a package that has more to it than the smell of new experiences and a shiny, intriguing bow that can distract the public from real issues.

The upcoming set of artificial intelligent innovations are flourishing but the public is unaware of these new technologies and the effect they could have on themselves as well as those around them. Artificial intelligence lives up to its name but lacks a deeper understanding of humanity: morals. The morality issue poses a threat; commending the lives of others in an autonomous technology is unreasonable. The ethics of artificial intelligence hide behind the fascinating innovations that display a perfect image of a better society along with change to technology as we know it. But the ugly and informational truth is always revealed.

Chapter 1: Autonomous Weapons, Hero or Villain?

One of the leading issues in the development of artificial intelligence is the topic of morality. The military is the major funder of artificial intelligence, hence, AI will be assisting humans in combat. Nevertheless, the development of lethal autonomous weapons, otherwise referred to as LAWS, will be possible within years, not decades. Currently, the military is using predator drones which are portrayed in Figure 1:

Figure 1: General Atomics MQ-1 Predator

Drone. https://en.wikipedia.org/wiki/General_Atomics_MQ-1_Predator

These predator drones are remote controlled; hence, humans still have manipulation over their targeting decisions. Advancements in technology have brought autonomous weapons to fruition

which will "select and engage targets without human intervention [but] they become lethal when these targets include humans" (Russell). This innovation has aroused controversy because there is no guarantee that autonomous weapons will efficiently target the enemy. Burdening a machine with the responsibility of deciding who lives and who doesn't seems unreasonable, "LAWS could violate fundamental principles of human dignity by allowing machines to choose whom to kill" (Russell). The lives of people around this advanced technology are at risk. When AI is asked to eliminate anyone demonstrating "threatening behavior", they may kill an innocent civilian for making the wrong move or having certain mannerisms that fall into the category of threatening. What does threatening look like? How will the robot know how to classify threatening behavior from normal behavior? Another significant question that emanates is, what would happen "if a robot had the choice of saving a soldier or going after an enemy combatant" (OHeigartaigh). Artificial intelligence cannot be entrusted with the lives of humans. Experts in their respective fields need to decide if they want to release or suppress this technology as they are the most knowledgeable on its societal impacts,

> "The AI and robotics science communities represented by their professional societies are obliged to take a position, just as physicists have done to the use of nuclear weapons, chemists on the use of chemical agents and biologists on the use of disease agents in warfare" (Russell).

The morality issue regarding lethal autonomous weapon systems (LAWS) has attracted a great deal of attention and a decision on whether they will be opposed or supported is pending. The military does not plan to leave the job on artificial intelligence.

Chapter 2: The Uneasy Ride of Driverless Vehicles

Google's driverless cars possess beneficial qualities that could favor society. They will provide safer driving at all times, drunk drivers will no longer pose a threat in the streets. Unlike humans, these autonomous cars will never be distracted either. Additionally, they will make the lives of Americans easier by driving them around, giving them the freedom to relax, socialize, tend to tasks, and enjoy the ride. This improvement has already been made "street-legal in three states, California, Florida, and Nevada… [they] may not just be possible but mandatory" (Marcus). According to Google, we can expect to see these modernized cars riding the streets soon. Figure 2 presents Google's newest project:

Figure 2. Google's driverless cars. Dietterich, Thomas G., and Eric J. Horvitz. "Rise of Concerns About AI: Reflections and Directions." *Communications of The ACM* 58.10 (2015): 38-40. *Academic Search Complete*. Web. 13 Dec. 2015.

Although these driverless cars appear to have resolved every issue it could possibly encounter, it has not. Any type of autonomous technology faces the morality issue because artificial intelligence has not advanced to the point of handling everything on its own; they need some type of human control. Google claims that,

"Deaths from traffic accidents – over 1.2 million worldwide every year – could be

> reduced dramatically, especially since 94% of accidents in the U.S involve human error" (Google Self-Driving Car).

Human error is a thing and it happens frequently but glitches in technology are also a problem. These highly-advanced cars can detect objects from miles away. The morality issue regarding driverless cars consists of a scenario that requires the car to make a quick decision on who it will decide to save, the driver or the children. In the scenario, the car is on a bridge riding at about fifty to fifty-five miles per hour and it detects a school bus on the same road. Out of nowhere, the school bus boarding forty innocent children crosses the path of the car, "should your car swerve, possibly risking the life of its owner, or keep going, putting all forty kids at risk?" (Marcus). These decisions will not be able to derive from the owner of the car, but from the car itself. The question of morality comes into play because these autonomous cars have no belief system on what is morally correct or incorrect. Advances in artificial intelligence have not reached the peak of creating sentient machines.

Seeking Communication

Artificial intelligence is a complex topic; therefore, it is true when experts in the field claim that the better the AI system, the harder it often is to explain. Nevertheless, society and experts need to bind the gap that is separating them due to a lack of communication. Society has the right to know what's going on behind the scenes. Once the debatable issues regarding advances in AI are resolved among the experts, an example could be the question of lethal autonomous weapons, information should be disclosed. Artificial intelligence should interest the public because they need to know the pros and cons to fast-advancing technology that will soon be a part of the community. Whether the innovation be as simple as a new phone with different updates, or a type of military weapon, society should be informed. Technology is already a part

of our everyday lives and children aren't unfamiliar with iPhones or other technologies. Five-year old's know exactly how to navigate an iPhone, take pictures, where to find games etc. Modern technologies are not only products that will be used by adults anymore, they're practically for everyone. However, the issue of communication is not one that should solely be addressed for parents because artificial intelligence is expected to be implemented into a vast amount of jobs as a form of assistance and betterment. In an attempt to transform health care, there will be developments in biology and medicine, "AI researchers who create the infrastructure and technical capabilities for these systems need to engage doctors, nurses, patient and others to understand how they will be used and be used fairly" (Hauert). Artificial intelligence is meant to facilitate jobs for humans. Updates would help workers in their respective fields because they would have an idea of what to anticipate, therefore, when the technology is completely finished they won't be flooded with all this brand-new information they've never heard about. Experts communicate with one another in order to determine the potential benefit or threat a technology could bring about. Society's input matters as well, therefore, "Debates should be organized at scientific meetings; arguments studied by ethics committees; proposition papers written for society publications; and votes taken by society members" (Russell). Researchers have shied away from the media and have stopped updating the public, but there's a solution to this issue.

The End is Not Near

Ultimately, artificial intelligence is not merely the perfect addition to society it appears to be. It's not all bionic and indestructible, it has its downfall characteristics as well. We are witnessing the beginning; the growth of AI only commenced years ago. Autonomous technologies are not ready for the responsibility of making humanly moral decisions.

Communication, on the other hand, can be easily solved; experts and society must join forces. Artificial intelligence is still too young to possess certain traits, but over the years, we can expect to see the technology maturing.

Technology is The New Black

Advancements in artificial intelligence are inevitable; it is hard to picture a future that doesn't involve the flourishing of technology. AI possess the potential to have a positive impact on society. In some aspects of society, artificial intelligence is guaranteed to play the role of the good guy, however, there are some areas that need to be refined. AI has not reached perfection; it is still in the process of growth. Proposals need to be made to establish some type of security for society. Artificial intelligence is a complex innovation that comes with pros and cons. As society takes steps towards a technology-based future, we must also take steps towards resolving the problems at hand.

More Money, More Security

Funding is the motor that drives developments in artificial intelligence. It covers the expensive costs that come with the process of creating and testing technologies. It is essential to maintain sources for funding because this will allow AI experts to experiment with a wide variety of research methods and toy with the way a technology is built. Companies rely on funding, "Open AI, a research company funded by $1 billion in donation from tech heavy-hitters Elon Musk, Sam Altman and Peter Thiel, launched Friday with the goal of advancing artificial intelligence" (Meyers). There are wealthy people out there that want to see improvements in AI, hence, they won't mind contributing to the cause. Funding is disbursed into different aspects; brining a technology to fruition is important but testing it requires equal attention. The MQ-1 predator drone, a remote-controlled military weapon, was tested at the Grey Butte Field Airport

in Palmdale, California. However, with new potential technologies that might emerge, such as lethal autonomous weapons, specific settings need to be considered as these technologies are not maneuvered by humans. Also, if something were to go wrong with the way a technology is built, for example, the current configuration is unsafe, funding will provide the freedom to switch things up in order to accomplish reliability. There are options as to which route experts can take in order to obtain funding. The National Science Foundation has a program, The Artificial Intelligence and Cognitive Science (AICS), that "supports research and related education activities fundamental to the development of computer systems capable of performing a broad variety of intelligent tasks, and to the development of computational models of intelligent behavior" (Artificial Intelligence). Then, there's the Future of Life Institute which has a website listing 2015 Project Grants Recommended for Funding. The projects range from "Applying Formal Verification to Reflective Reasoning costing $36,750 to Safety Constraints and Ethical Principles in Collective Decision Making Systems amounting to $275,000" (2015 Project Grants). Websites like these help experts and their projects get noticed. Because funding is a catalyst to the improvements of artificial intelligence, the more there is, the better.

AI of the People, By the people, for the People

There is a lack of communication between the public and experts working on upcoming technologies. Society is composed of tax payers that feed the government money which is sometimes invested into technology. The military is the major funder of artificial intelligence. There needs to be a policy declaring that every technology must hold public forums or find a way to communicate their advancements every 5 months to keep society updated. Although this proposal seems unrealistic, Google, one of the major companies specializing in "internet-related services and products" (Google Self-Driving Car), provides the public with monthly reports on

their Self-Driving Car Project. Although this project has been in the process for six years, Google has recently started releasing information; it's a start to binding the gap in communication. Each report is in the format of a PDF ranging from 2009-2016 (Google Self-Driving Car). In each downloadable report, they delineate progress they've made over the course of a month which allows society to be informed of updates and changes that are going on behind the scenes. In brief, the public should be able to know what to expect from new AI technologies.

You're in Good, Robotic Hands

The morality issue in autonomous technologies is a concerning topic. This problem could possibly put the lives of humans at risk, therefore, measures towards improving safety should be taken. Google's Self Driving Car Project should install a software in the car with a set morality program, this will assure that a consumer won't enable the car to act recklessly. People, crazed murderers in particular, could possibly take advantage of this technology by setting it up to cause fatal situations. Morality settings will come with the car; however, the owner decides the action it would want the car to make if ever put in a complicated situation. The car will either save the owner or save the 40 innocent children aboard the school bus. Allowing consumers to configure morality settings to their liking will eliminate the car's indecisiveness and provide the consumer with reassurance because the decision made by the car will be a decision made by them.

Onto Bigger Steps

Artificial intelligence is young and it is bound to have a long-life expectancy. AI has taken its baby steps and they're growing day by day; they're also getting smarter. Experts such as Kurzweil and Kaku have stated their position but only the future will reveal what artificial intelligence has in store for society. As the year's pass, artificial intelligence will continue to improve. In due time, there will be a solution for the issues AI encounters. Because it's so young,

mistakes are common but there's always room for enhancement. Its steps will not only get bigger, they will leave an imprint on society as we know it.

References

"Artificial Intelligence and Cognitive Science." *National Science Foundation*. N.p., n.d. Web. 16 Dec. 2015. <http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5211>.

Brasher, Joan. "Out of the Deep." *Vanderbilt MyVU*. N.p., 1 Aug. 2011. Web. 14 Nov. 2015. <http://news.vanderbilt.edu/2011/08/out-of-the-deep-hutto/>.

Cadwalladr, Carole. "Are the Robots about to Rise? Google's New Director of Engineering Thinks So..." *The Guardian.com*. N.p., 22 Feb. 2014. Web. 17 Oct. 2015. <http://www.theguardian.com/technology/2014/feb/22/robots-google-ray-kurzweil-terminator-singularity-artificial-intelligence>.

Dietterich, Thomas G., and Eric J. Horvitz. "Rise of Concerns About AI: Reflections And Directions. "*Communications of The ACM* 58.10 (2015): 38-40. *Academic Search Complete*. Web. 21 Nov. 2015.

"General Atomic MQ-1 Predator." *Wikipedia*. Wikimedia Foundation, n.d. Web. 14 Dec. 2015. <https://en.wikipedia.org/wiki/General_Atomics_MQ-1_Predator>.

"Google Self-Driving Car Project." *Google Self-Driving Car Project*. Google, n.d. Web. 13 Dec. 2015. <https://www.google.com/selfdrivingcar/>.

Hauert, Sabine. "Shape the Debate, Don't Shy from It." *Nature* 523.7558 (2015): 24-26. *Academic Search Complete*. Web. 21 Nov. 2015

Hodgekiss, Anna. "'I Feel like The Terminator': Father Who Lost His Arm in an Accident Is Fitted with Amazing Bionic Arm That Even Lets Him Touch-type." *Mail Online*. Associated Newspapers, 05 Nov. 2012. Web. 18 Oct. 2015. <http://www.dailymail.co.uk/health/article-2228107/The-bionic-arm-

thats-sophisticated-touch-type.html>.

Kaku, Michio. *Physics of the Future: How Science Will Shape Human Destiny and Our Daily Lives by the Year 2100*. New York: Doubleday, 2011. Print."

KurzweilAI | Accelerating Intelligence." *KurzweilAI Ray Kurzweil Biography Comments*. N.p., n.d. Web. 18 Oct. 2015. <http://www.kurzweilai.net/ray-kurzweil-biography>.

Kurzweil, Ray. "Promise and Peril -- The Deeply Intertwined Poles of 21St Century Technology." *Communications of The ACM* 44.3 (2001): 88-91. *Academic Search Complete*. Web. 14 Nov. 2015.

Marcus, Gary. "Moral Machines." *The New Yorker*. N.p., 12 Nov. 2012. Web. 12 Dec. 2015. <http://www.newyorker.com/news/news-desk/moral-machines>.

Meyers, Michelle. "Elon Musk Helps Fund AI to Protect Humanity - CNET." *CNET*. N.p., 11 Dec. 2015. Web. 17 Dec. 2015. <http://www.cnet.com/news/silicon-valley-bigwigs-fund-artificial-intelligence-nonprofit/>.

OHeigeartaigh, Sean. "Practical Ethics." *Practical Ethics*. University of Oxford, 9 Aug. 2013. Web. 21 Nov. 2015.

"Ray Kurzweil on "I've Got a Secret"" *YouTube*. YouTube, n.d. Web. 18 Oct. 2015. <https://www.youtube.com/watch?v=X4Neivqp2K4>.

Metz, Cade. "Robots Will Steal Our Jobs, But They'll Give Us New Ones." *Wired.com*. Conde Nast Digital, 24 August 2015. Web. 14 Nov. 2015. <http://www.wired.com/2015/08/robots-will-steal-jobs-theyll-give-us-new-ones/>.

Russell, Stuart. "Take a Stand on AI Weapons." *Nature* 523.7558 (2015): 24-26. *Academic Search Complete*. Web. 21 Nov. 2015.

Salisbury, David. "Robotic Advances Promises Artificial Legs That Emulate Healthy Limbs." *Research News at Vanderbilt*. N.p., 7 Nov. 2013. Web. 13 Nov. 2015. <http://news.vanderbilt.edu/2013/11/robotic-legs-healthy-limbs/>.

Shyamasundar, R. K. "The Computing Legacy of Alan M. Turing (1912-1954)." *Current Science (00113891)* 106.12 (2014): 1669-1680. *Academic Search Complete*. Web. 14 Nov. 2015.

"'Terminator' Arm Is World's Most Advanced Prosthetic Limb." *YouTube*. YouTube, n.d. Web. 18 Oct. 2015. <https://www.youtube.com/watch?v=_qUPnnROxvY>.

"2015 Project Grants Recommended for Funding." *Future of Life Institute*. N.p., n.d. Web. 16 Dec. 2015. <http://futureoflife.org/first-ai-grant-recipients/>.