

# Current and Future Relationships Between Robots and Humans

Summa Paper

Presented in Partial Fulfillment of the Requirements to  
Graduate Summa Cum Laude

By

Miguel Velez

Undergraduate Program in Computer & Information Sciences

University of St. Thomas

2015

Committee:

Professor Patrick Jarvis, Chair and Advisor

Professor Paul Ohmann

Professor Buffy Smith

In this summa paper, I present the topic of relationships between humans and robots, integrating my Computer Science major, Physics minor, and the liberal arts. I first present a brief history of robots and describe how a specific robot with which I have worked operates and interacts with its environment. I then describe the relations that humans have with robots both in the workplace and in their personal and intimate lives. I conclude that, while robots might be able to perform some jobs that humans do, thus affecting the people that work in that sector, they are not able to replace all jobs that humans do. Regarding personal relations, I conclude that humans are able to have a personal and intimate relationship with robots due to the rapid progress of robots looking, behaving, and feeling like humans beings.

The history of robots can be traced to medieval times [4]. During this period, people conceived the idea of human-like figures that performed human-like tasks. These figures were run by hidden mechanical components providing the illusion of autonomous movement. Most of these artifacts were toys, but the technology used was adapted to other applications. For many years, people developed mechanical artifacts that helped humans do their jobs such as clocks, cranes, boats, and cars. With the arrival of computers in the 1940s, people turned their attention to programming complex mechanics in devices run by electricity that performed tasks that humans would do. This was the time that the word “robot” became widely used. An example of the application of this technology is the automobile industry that used industrial robots to assist in the assembly of cars, thus increasing their productivity and, ultimately, reducing production costs while simultaneously increasing quality. Although robots have facilitated the work done by humans, research shows a trend of robots becoming part of people's personal and intimate lives.

Before discussing the relationship that we have or could develop with robots, I will first discuss the components of a robot and how they help it to perceive and interact with its environment. Since there are many different kinds of robots with different components, I will focus on the `iRobot Create` that I currently use in my Artificial Intelligence and Robotics class [9]. The `Create` is a disk-shaped programmable robot attached to an Arduino Mega 2560 microcontroller. I use the Arduino programming environment to develop software

in the C programming language to control the **Create**. The programs that I write use the **Arduino Roomba** library which provides an object-oriented application programming interface (API) with several functions and methods specific to the **Create**. My typical work cycle is to write my program, compile it, and upload it to the Arduino microcontroller via a USB cable. Once my program is uploaded in the Arduino, it controls the **Create** by executing the commands that I programmed.

The **Create** has several sensors to perceive its surroundings and actuators which allow it to act in its environment. The sensors are multiple cliff sensors, front bumper, wheel drop sensors, and wall sensors. The front bumper is an optical interrupter composed of an LED and a photodetector where the former shines a light and the latter detects it. When the bumper is hit, a mechanical interrupter is placed between the LED and the photodetector. The interrupter prevents the photodetector from sensing the light from the LED which then triggers a signal. The cliff and wall sensors work in a similar manner. The only difference is that these photodetectors sense the LED light reflected from the ground or a wall. The wheel drop sensors have a microswitch that triggers a signal when the wheels are fully extended. The actuators are a speaker and motor which allow the **Create** to act upon the environment. The speaker allows the **Create** to output tones and the motor turns the wheels which move it [6]. Now that a basic understanding of how robots work has been established, I will describe relationships between humans and robots that we can see in the workplace.

Job security is a major concern for humans. Having a secure job increases and maintains our emotional happiness and being productive gives us a sense of accomplishment and well-being. Unemployment is a worldwide social problem that affects not only the unemployed individual, but also society as a whole. In the past few decades there has been an active debate about the future of the workplace with the inclusion of robots in our daily work. Robots working alongside humans or even replacing them is not an uncommon situation. The automobile industry has workers working alongside robots that assemble cars with high precision. Robots controlled by humans have also been used to perform dangerous tasks such as exploring dangerous areas or deactivating bombs. While these

examples are not very controversial, due to having good reasons for implementation such as safety and optimization, there are other instances which are quite controversial because the implementation of robots has led to complete replacement of human workers.

In the past few years, the health care industry has integrated robots in its daily tasks. Some of them are used for remote tasks. There are some doctors who use robots to check on and communicate with patients. They use software involving joysticks and computers to control the robot and are able to see and communicate with the patient. Also, there are robots used for teaching purposes or supervision during operations. Groups of students learn from a doctor in a different location who controls a robot that performs the actions that he or she is teaching, and he or she can also supervise the actions that the students are performing on a patient. While these robots have expanded the access to health education, there are other types of robots used during surgery that are replacing some high status members of the surgical team. These types of robots are controlled with joysticks by the lead surgeon and are able to hold in place and manipulate cameras and surgical instruments better than their human counter parts. Although this gives more work to the lead surgeon, studies report that they prefer to have more control during surgeries since it improves their productivity and reduces the chance of human error produced by other members of the team [10] [12].

Both in fiction [2] and real life [11], there are many examples of robots facilitating the work that we do by performing dangerous or repetitive tasks which allow us to improve our productivity. However, we become concerned when robots are able to perform and improve upon the work that we do. I believe that in the short term, being replaced by robots affects both the people being replaced and society as this will lead to higher unemployment. However, in the long term, this allows people to abandon performing repetitive and simple tasks and concentrate more on other jobs that are not tedious and monotonous. This also applies to workers who are not completely replaced by robots since they would have “assistants” for some of their tasks and would be able to work on more challenging tasks. Further, some of the current work that robots do is not flawless. As a result, not all people will be replaced, since companies do not want to risk losing customers due to bad service. Finally, it will take

many years, or decades, for a complete work sector to be fully replaced by robots, which will allow current and future workers of that field to anticipate and prepare for this change if and when it occurs. Now that I have discussed the impact that robots have had and might someday have in the workplace, I will examine the social and personal relationships we currently have and could have with robots.

Our family is an essential part of our lives since we share a special connection with them. Our family provides us with support, protection, care, warmth, and acceptance; feelings that we also provide to them since we love and desire the best for them. For many years, we have seen that these feelings are not limited only to other humans. We also express and receive those feelings from pets and recently we have seen those feelings expressed to and from robots. **Robovie** is a humanoid robot used to research social interactions with children ages 9, 12, and 15. **Robovie** is actually controlled remotely by a human, thus displaying human like actions and allowing researchers to see how humans react when a human-like robot interacts with them. The children felt awkward when left alone in a room with **Robovie**, but later broke the tension by talking to the robot and making eye contact with it. The resulting conversations between the children and **Robovie** were intelligent and included topics about how they felt and how their days were going. The children also took walks with **Robovie**, walking relatively close to each other. They waited for **Robovie** whenever it stopped and walked slower in order to match the robot's speed. They also expressed care and support for **Robovie** when researchers called it “just a robot” by interjecting that “he is not just a robot.” It might be hard or impossible to believe that we humans can have emotional attachments and care towards a robot. In our houses we have several electrical and mechanical appliances, but we do not have emotional feelings of protection, care, and love towards them. The key difference between this research and regular appliances is that the latter do not mimic human-like behavior. It is natural for us to respond with human-like behavior if we perceive it from another person, a pet, or even a robot [5].

We human beings, as animals, have a natural desire to have sexual relations. Some people form an institution with a partner with whom they have sexual relations, in addition

to many other benefits of being with a stable significant other. Other people, due to several reasons, prefer to hire and pay other humans to have sexual relations with them. In recent years, there has been a growing trend of robot manufacturers building robots with sexual capability that includes masculine (*malebots*) or feminine (*fembots*) artificial genitalia. These robots have raised questions about the extent of relationships that humans have with robots.

In Japan, a group of people desired to run a regular “call girl” service until they found out that other companies use *fembots*. Since the labor costs of having these robots were cheaper than having humans, they decided to purchase some. Their business was such a success that, within one month, they covered the costs of buying the *fembots*. Another example comes from the growing prostitution problem in South Korea during the past decade. In 2005, sex robots were introduced for rent after the government banned prostitution. This raised many ethical and legal questions as to whether paying to have sexual relations with a robot is prostitution. Leaving ethical questions aside, these examples clearly show that humans are willing and able to have sexual relations with human-like robots. Although the previous examples have shown that males are willing to have sexual relations with *fembots*, there are also many women who have sexual interactions with *malebots*. David Levy, author of the book “Love + Sex with Robots” [7], has expressed many opinions about sexual relationships between humans and robots. He has argued that since vibrators found in local pharmacies have been a huge commercial success, it would not be surprising for *malebots* to also have great commercial potential. Additionally, he argues that the practice of humans having sexual relations with robots will be commonplace by the year 2050 [8] [1].

The book “I, Robot” by Isaac Asimov [2], discusses not only the Three Laws of Robotics, but also both personal and work relationships that humans might have with robots. Although it is a fictional book, it will not take too long to see those trends happen in the real world. I believe that we are able to develop a personal relationship with robots that act and behave like humans or pets. I find it hard to believe, as many people would, that people could care and protect their laptop as they care and protect their parents or dogs. However, I am certain that if laptops would talk, care about their owners, and look human,

then it would be easy for people to develop a personal relationship with them. Although we currently do not have many robots that look like dogs begging to be taken out for a walk, there is a growing industry of sex robots that are being used by humans for sexual relationships. These robots have affected society twofold. First, it has had a huge economic impact for the people who manufacture these robots and the companies that rent them out to people [8]. This clearly shows that we humans are willing to engage in sexual relations with robots, attributable to robots looking and feeling like a real person. Humans want attention and contact with other human beings. If there are robots that can simulate those features realistically enough, it is not surprising to me that some would replace human contact, even sexual relations, with robot contact, in order to satisfy that need. The second issue is the ethical and moral questions that arise when people have sexual relations with robots. There are many people who believe that sexual relations with robots would affect society in a negative way, especially marriages and the way that people perceive people of the opposite sex [3]. There are also several concerns about loyalty to our spouses if married people engage in sexual relations with these robots, as well as how people who are involved in this practice would be perceived by the rest of society [1]. There has been a large amount of analyses on these topics, and I honestly believe that there are several good arguments on both sides of the discussion. Nevertheless, now that companies are developing robots to not only act, but also to look and feel like humans, I have no doubt that people will continue to have personal and intimate relationships with these robots and it will become commonplace in the near future.

The study of relationships between humans and robots has attracted the attention of the general public in the past few decades, more so now that robots are becoming more common both at work and in our daily lives. In the workplace, we have seen that robots are able to help and assist us to perform dangerous and difficult jobs. Moreover, there are cases where robots have completely replaced a skilled human being to perform delicate and important jobs. I argue that while there are some jobs that robots are able to perform instead of humans, certainly affecting that economic sector, the vast majority of jobs are not

able to be fully taken over by robots in the near future. Having robots that perform some work for us increases our productivity and allows us to concentrate on more important and challenging tasks. If robots are able to replace an entire work sector, it would take many years, allowing people time to transition to other jobs that robots have not or could not take over. Regarding personal relations, I argue that since robots are beginning to look, behave, and feel like humans, it is very possible for us to develop personal and intimate relationships with them. It will not be very long until we have robots that look and behave like dogs being walked by humans, or people being depressed because their robot friend is gone or has “passed away”. The industry of sex robots is growing rapidly and has had a high acceptance among people because of the human-like features that those robots offer. This has raised many moral and ethical questions about the use of these robots and how would it affect the institution of marriage and society as a whole. Nonetheless, sex robots will certainly become more common in society and its use and availability will increase in the coming years. Robots are certain to become an ever-increasingly important part of daily life, but it will be up to society to determine the degree of acceptability of robots in the workplace and in our personal lives.



# Bibliography

- [1] Yusuff Jelili Amuda and Ismaila B Tijani. Ethical and legal implications of sex robot: An islamic perspective. *OIDA International Journal of Sustainable Development*, 3(06):19–28, 2012.
- [2] Isaac Asimov. *I, robot*. Spectra, 2004.
- [3] Sinziana Gutiu. Sex robots and roboticization of consent. In *We Robot Conference*, 2012.
- [4] Christopher Haggis. *History of robots*. 2003.
- [5] Peter H Kahn Jr, Jolina H Ruckert, Takayuki Kanda, Hiroshi Ishiguro, Aimee Reichert, Heather Gary, and Solace Shen. Psychological intimacy with robots?: using interaction patterns to uncover depth of relation. In *Proceedings of the 5th ACM/IEEE international conference on Human-robot interaction*, pages 123–124. IEEE Press, 2010.
- [6] Tod Kurt. *Hacking Roomba: ExtremeTech*. ExtremeTech Series. Wiley, 2006.
- [7] David Levy. *Love + sex with robots: The evolution of human-robot relationships*. Duckworth Overlook, 2009.
- [8] David Levy. Robot prostitutes as alternatives to human sex workers. In *Proceedings of the IEEE-RAS International Conference on Robotics and Automation (ICRA 2007), Workshop on Roboethics, Rome, Italy, (April 10–14, 2007b)*, 2009.
- [9] Kate Lockwood. University of St. Thomas, Artificial Intelligence and Robotics, 2015.

- [10] Eivor Oborn, Michael Barrett, and Ara Darzi. Robots and service innovation in health care. *Journal of health services research & policy*, 16(1):46–50, 2011.
- [11] Richard S Rosenberg. The social impact of intelligent artefacts. *Ai & Society*, 22(3):367–383, 2008.
- [12] Kristian Wasen. Replacement of highly educated surgical assistants by robot technology in working life: Paradigm shift in the service sector. *International Journal of Social Robotics*, 2(4):431–438, 2010.