

Thesis Project Portfolio

Autonomous Foosball Opponent

(Technical Report)

Robots for the Rich:

A Socioeconomic Impact Analysis of the Development of Robotic Technology

(STS Research Paper)

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Executive Summary

This portfolio is comprised of an STS research paper and technical project both centered around autonomous robots as replacements for humans. The STS research paper explores the impacts that robots have had on society throughout their lifetime of development. The discussion takes particular interest in how marginalized people groups in society are disproportionately detrimentally affected and how that impact was prescribed, however inadvertently, by those in power that shaped the technology. The technical project similarly explores the field of robotics through the development of a robotic system to play against a human on a miniature foosball table. Though arguably not a major societal issue, this project offers the team an insight into the production of robotic systems. The technical project was done on a constrained budget in a short timeframe, and thus provides an example of how robotic technology could be made more accessible with lower cost development. These projects also connect through the examination of robots replacing people. The research paper analyzes what jobs are or have the potential to be replaced by robots and the robotic foosball table attempts to recreate human actions in the game of foosball to take the place of a human player.

The robotic foosball table is an autonomous system that operates one side of a foosball table to play against a human opponent. The system consists of a mechanical interface to control the foosball players, a camera and Raspberry Pi microprocessor to detect the ball and plan a response, and a microcontroller connected to custom-designed printed circuit boards (PCBs) to control the motors and collect sensor data. Each of these subsystems is physically connected to one another such that information regarding the state of the foosball game can be collected, processed, and converted into a desirable response like blocking an opponent shot or scoring a

goal. This project is an example of robotic automation of a typically human task. While this application is for entertainment, demand for similar technologies is growing rapidly.

Aside from their applications for foosball entertainment, from safer manufacturing to more precise surgery, robots have inarguably impacted society and benefited many. Though a relatively young field, robots have advanced rapidly since their introduction, becoming increasingly capable and autonomous, but when do these advancements stop being beneficial or even become harmful to the people they were intended to help? Utilizing the framework of technological momentum by following the development of robots from their inception to the present and foreseeable future, this paper answers the question: How have developments in robotic technology historically impacted the socioeconomically marginalized, and how might they in the future? First through a literature review, the following analysis traces the history of robots and the spaces that they have inhabited since their birth, and then, through discourse analysis of more modern and informal sources, gauges current public sentiment surrounding robots and their direction academically and industrially to understand how robots have been shaped by their time and place and how they might come to shape their environments, both present and future, as they continue to become more intricately woven into the fabric of society.

Simultaneously completing both the research and technical projects illuminated both the importance and difficulties associated with developing a new robotic system. The technical project of the robotic foosball table began with a small budget and quickly evolved to double that. The team was able to learn exactly what it costs to create such a complicated system capable of simulating a human action. The concurrent work also provided insight into what it takes for a robot to replace a human. The research paper discusses the harm that replacing people in the labor force can do, especially to those of low socioeconomic status, and while the technical

project does not seek to replace any jobs, except potentially those of professional foosball players, its explicit aim was to meet and surpass human capabilities. Given the success at the end of the project of the robot being able to play foosball well and competitively combined with the great cost required to achieve such performance, it became clear that those with wealth often have the most influence over what robots will become and who they will impact or replace. This socioeconomic influence makes it imperative that those developers consciously seek justice and equity through their work, and this sentiment must be carried forth into the real world.