

Thesis Portfolio

The Smithinator: Recumbent Vehicle Design and Entry for the 2020 ASME Human-Powered Vehicle Challenge

(Technical Report)

Robots and Society: Robots Influence on Manufacturing

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

The goal of engineering is to create a product that is manufacturable and profitable. In manufacturing, the goal is to create the product that people want at a competitive price for the market of that product or service. There are two projects in this portfolio that address manufacturing in two separate views. The Human Powered Vehicle Challenge (HPVC) is the technical portion of the report. The goal of this project is to design a vehicle that meets certain criteria from the American Society of Mechanical Engineers (ASME) and the team's objectives. In addition, the design had to be manufacturable based off the available machinery and skills at the Lacy Hall. In the STS research portion of the portfolio the focus was on how robotics has and will continue to impact manufacturing. The motivation was to understand the relationship between evolving manufacturing methods with the labor market. Furthermore, how the relationship impacts American society and economics. The common factor between the two projects was the difference of manufacturing processes of building a custom vehicle for the HPVC versus the mass manufacturing methods of identical products.

The HPVC is a competition that tasks teams from around the world to design and build a vehicle that can be powered by a person. The mission statement by ASME is to encourage engineering students to consider the social, environmental and economic benefits of the vehicles they design. The first set of criteria given to the team is a set of safety rules that apply to all phases of the design from structural forces, deflections, safety harnesses, and braking. However, the team set forth other goals for design objectives such as gearing ratios, turning radius, weight, and steering. The design choices are made with respect to the manufacturability and timeline of the project. The available machinery was a waterjet, TIG welder, CNC, mill, lathe, grinders, and other handheld tools over a semester of construction. The final design is a tadpole recumbent

bicycle with Ackermann steering configuration made of 4140 steel. Finally, the design and manufacturing were the objectives of the challenge in order to build a unique vehicle.

The unique nature of special builds is not a large part of the economy any more with factories producing large scale identical products. In 2013 Oxford researchers Carl Frey and Michael Osborne theorized that forty seven percent of jobs in the United States are at risk of computerization (Frase, 2016). The IEEE defines a robot as a machine that is able to interpret the environment and make calculations. Therefore, the technical advancement now makes robots a viable method of labor that can compete with humans. The research proposal is the study of integration of robots into manufacturing and the corresponding impact on society. To study this effect of robots on the society and the economic impacts the research paper looks at the automotive industry. The automotive industry has a long history of employment history and values displayed in America. The industry was also an early adopter of robots in the late 1970's, which allows historical case study of robots impact on the community. In addition, using discourse analysis to get society's perception of robots using newspaper articles. Furthermore, using disruptive technology regulations with code of ethics for roboticists to understand the impacts that robots have on society. Paradigms shift theory is used to study the impact of robots as models change as is inherent in disruptive technologies. Finally, the expected result is to learn the impacts that robots will have on society and economy. In addition, to use expert methods to implement ways to adapt to the changing labor climate. The significance to the research community is to understand a modern problem of labor in America, and to possibly limit negative outcomes.

To conclude, there were major differences in the approach to manufacturing in a custom environment versus the mass manufacturing. The custom environment was mostly done by hand

making alterations to the design based off the lessons learned throughout the process. It emphasized the tailored nature to the product, and the individuality of the project. In mass manufacturing methods and processes are designed to create a constant stream of products that are identical. This introduces the main point of during my research portion of how robots are impacting manufacturing landscape. That robots can perform repeatable tasks that are coded into the machine, however are not good at creating custom designs. The technical HPVC displayed that the custom manufacturing scene with the pervious practices and perceptions of manufacturing before robot's introduction. In addition, the research portion displayed the nature of shear volume that mass manufacturing goes through and that previous practices would simply not work. To conclude that each experience has given insight on the other project in a global landscape.