Thesis Project Portfolio

Design and Construction of Modern University of Virginia Themed Pinball Machine

(Technical Report)

Mechanical Engineers and Their Relationship with Sustainability

(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

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Executive Summary

Mechanical engineers have the opportunity to create and design systems that people can use every day. This enables them to affect peoples' everyday lives, either in a positive or negative way. For the technical section of this report, the work concerning the creation of a pinball machine is described. An example of a famous game, mechanical engineers can create components within such a device, and provides ample opportunity to use engineering principles for peoples' enjoyment. For the STS section of this report, the relationship between mechanical engineers and sustainability is studied. While their ability to design can help bring innovative technologies into reality, it may be detrimental if these designs fail to consider how they contribute to climate change and society, and how to mitigate such effects. As the pinball machine is an example of a creation from scratch, it is an opportunity for mechanical engineers to consider sustainable design thinking in the process. As mechanical engineers continue to create new systems, how do past examples and upcoming projects provide insight into what our role is as mechanical engineers to enforce sustainable design?

For the pinball machine, the design was undertaken by a team of mechanical engineers. Together, we designed pinball components from scratch and determined how to fit those new components in an old chassis. By gaining practical experience with iterating designs and building components, we learned how mechanical engineers are capable of creating systems that can move dynamically. Through these dynamic components, we were able to create parts that were able to interact with a pinball.

After design work, we compiled our technical report which includes documentation concerning the steps we took to build the machine. The report details the step-by-step process of

design and provides a good understanding of the mechanical engineering production process, which can be analyzed by a sustainability lens based on the work in the next paragraph.

For the STS portion, the relationship between mechanical engineers and sustainability was investigated. Seen in the aforementioned technical work, mechanical engineers have the opportunity to realize designs and bring systems to life. With this ability, there is a responsibility associated with their work, making sure what they bring into the world enriches it, instead of damaging it. In order to investigate this question, literature concerning what sustainability means in different disciplines was analyzed and compared to develop a holistic idea of sustainability that mechanical engineers may refer to.

The findings of this investigation were that mechanical engineers prioritize optimizing their production in exchange for increased profits, along with increased longevity of their products. In other disciplines, in addition to less popular sentiments in the mechanical engineering discipline itself, sustainability also concerns mental health, well-being, and social responsibility in its considerations. The outcome of these findings were that sustainability can be applied in many different areas, and mechanical engineering designs can be made more robust if the designers themselves consider additional facets of sustainability, like the mental health, wellbeing and social responsibility aspects.