

**Thesis Project Portfolio**

**Design and Construction of Modern University of Virginia Themed Pinball Machine**

(Technical Report)

**Evolution of Pinball Machines and the Time That America Outlawed Pinball**

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

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## **Sociotechnical Synthesis**

### **Introduction**

Both my STS research project and my technical capstone related directly to the classic arcade game of pinball. The technical project focused on the development of University of Virginia (UVA) themed pinball machines with components designed, prototyped, and manufactured in house. This project showcased the technical team's competency with the engineering design process while working to build an attractive physical display for the engineering department. The STS research project took a larger view of the game of pinball and its history, breaking down the game as one designed to comprise aspects of both luck and skill. This paper highlights the case study of the progressive evolution of pinball towards a game of mostly skill with an emphasis on the role of pinball designers, manufacturers, and players. This is an important case study because it considers an instance where engineering design choices directly influenced policy.

### **Technical Project**

Due to pinball's early origins in the 1930s, not all the machine's components reflect the current technological progress society has made – resulting in inefficient and outdated mechanisms. The purpose of this technical project was to redesign the pinball machine. While focusing on a UVA theme, the goal was to improve and even reinvent pinball mechanisms to reflect present-day knowledge of mechatronics, a field which integrates mechanical engineering, electrical engineering, and computer science together synergistically to simplify and streamline the intricate mechanical mechanisms of the past. Key aspects of the pinball machine included custom flippers, drop targets, pop bumpers, ramps, ball traps, vertical up-kickers, and ball save

mechanisms. These features were designed around the UVA theme with specific examples being a cast iron rotating rotunda as both a centerpiece of the machine and a main obstacle in the game, models of Scott Stadium and the Beta Bridge, and a scoring system based on credit hours. Many of the designs of these components were finalized, but future work by students in the coming years will be necessary to finish the construction of remaining components for the pinball machine.

### **STS Project**

My STS research paper seeks to understand why pinball was banned throughout the United States in the mid-20th century. It emphasizes pinball's early years as a time in which pinball machines were manufactured largely for gambling implementations and notes a shift (beginning around 1947) where components that and game rules rewarded player skill were introduced. Noteworthy examples leading to this shift were the invention of flippers in 1947 and drop targets in 1962. Altogether, the STS research paper presents the culmination of research into the design choices and political factors that led to the banning of pinball, the changes in the design of the pinball throughout the ban, and a direct examination of the banning of pinball in New York City from 1942 to 1976. The analysis of the STS research paper employs the concepts of "insiders" and "outsiders" from Carolyn Marvin's "Inventing the Expert" to examine the roles of pinball manufacturers and skilled pinball players as "insiders" and the government officials in charge of passing and enforcing pinball bans as "outsiders" (Marvin, 1988). This analysis highlights the role of expertise in the case study of the banning of pinball in New York City.

### **Conclusion**

By working on both of these projects simultaneously, I have not only gained an appreciation for the design of complex devices (like pinball machines), but I have also gained insight into the importance in considering the history of technologies and its implications. In my technical project, I was able to see firsthand the process of iteratively designing, prototyping, and manufacturing individual components. Additionally, I gained experience in having to test and correct designs of the individual components based on how they combine synergistically in the larger system of the fully assembled pinball machine. This appreciation for the design of pinball machines left me inspired to conduct research for my STS project. Speaking of, the lessons I learned from my STS research project made me more knowledgeable about how pinball components were implemented on antique machines and inspired me to ensure a plethora of skill-based features were implemented on the UVA themed pinball machine.