

Thesis Project Portfolio

Design and Construction of Modern University of Virginia Themed Pinball Machine

(Technical Report)

The Science of Chance: Exploring the Connection Between Engineering Design and Gambling

(STS Research Paper)

An Undergraduate Thesis

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

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In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

This synthesis report summarizes the findings from my technical project on designing a UVA themed pinball machine, and my STS research focused on the ethical implications of designing gambling technologies. Both projects are connected through their core objective: to explore and refine how user engagement mechanisms are integrated within system designs. The pinball project used advanced design and manufacturing techniques to enhance user interaction, while the STS research aimed to identify and mitigate ethical issues in addictive gambling technologies. In the technical endeavor, my team and I developed a pinball machine that not only serves as entertainment, but also incorporates elements designed to maintain and increase user engagement responsibly. This project parallels the concerns addressed in my STS research, where I investigated the manipulative design practices in gambling and proposed a new framework, the Ethical Design and Engineering Framework for Gambling Technologies (EDEFGT), to guide the creation of ethically sound gambling systems.

Project Summaries

The technical aspect of my thesis involved the design and assembly of a UVA themed pinball machine using SolidWorks for CAD design, 3D printing for creating ABS plastic parts, laser cutting for acrylic details, waterjet cutting for aluminum components, and other mechanical work for parts and design. This machine was engineered to include mechatronics for enhanced electronic functionality, operated by microcontroller chips (Propellor 2) that govern gameplay mechanics. Our design aimed to optimize the user experience by implementing UVA themed features that promote continuous play without unethical manipulations.

My STS research critically examined the engineering designs behind gambling technologies, focusing on how these systems are deliberately engineered to be addictive. The investigation led to my development of the Ethical Design and Engineering Framework for Gambling Technologies (EDEFGT), which proposes new standards and regulations to inhibit the unethical manipulation of users. This framework emphasizes transparency, fairness, and accountability, aiming to reshape how gambling technologies are conceived and implemented. My research highlighted the need for industry-wide reforms based on ethical principles that safeguard user interests while allowing for engaging and profitable gaming experiences.

Conclusion

Engaging in both the pinball machine design and the exploration of gambling ethics revealed the significant impact of engineering decisions on user engagement and societal norms. These projects enhanced my technical proficiency and deepened my understanding of the ethical landscapes in technology use, particularly in how entertainment technologies can influence user behavior. This work highlights the necessity for ethical frameworks like the EDEFGT, which help guide the development of technologies that are engaging and morally sound. The insights gained from these projects advocate for a balanced approach to technology design, where user welfare is as significant as technological innovation.

I acknowledge the support and wisdom of my academic advisors: Dr. Richard Jacques, who provided guidance, resources, and insightful feedback for my STS research, and Dr. Gavin Garner, my technical advisor, whose expertise was crucial in the execution of the pinball machine project. Their contributions were vital in addressing the ethical and technical complexities of my work.