

UVA Themed Pinball Machine

(Technical Project)

Evolution of Pinball Machines and the Time That America Outlawed Pinball

(STS Project)

A Thesis Prospectus

In STS 4500

Presented to

The Faculty of the

School of Engineering and Applied Science

University of Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science in Mechanical Engineering

By

Jacob Leynes

October 27, 2023

Technical Team Members:

Mina Ansari, Olivia Bearman, Phillip Bongiorno, Adam Centanni, Ian Chang, Thomas Cook,
Benen Crombie, Scott Durkin, Ethan Green, Tom Habron, Matthew Leclair, Isaac Leshok,
Gabriel Lu, Will McClung, Patrick Nguyen, Keith Tam

On my honor as a University student, I have neither given nor received unauthorized aid
on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

ADVISORS

MC Forelle, Department of Engineering and Society

Gavin Garner, Mechanical and Aerospace Engineering

Introduction

Upon its invention in 1931, coin operated electronic pinball was created as a form of cheap amusement following the great depression. (Klein, 2016). However, the game as it was then is not easily recognizable compared to the arcade classic of today. That is because at the time of its invention, pinball was an entirely luck-based game until 1947 when the first flippers (the levers used to hit the ball back in play) were invented. (Terry, 1993). Because of the luck-based nature of pinball at this time, the line was blurred between pinball and gambling machines like slot machines. In 1942, pinball was banned in New York City to crack down on gambling and people betting on the outcome of games. (Klein, 2016). Despite the advent of the flippers and other skill-based features, the ban was not lifted until 1976 when Roger Sharpe famously made a difficult shot in a Manhattan courtroom as popularized by the 2022 film *Pinball: The Man Who Saved The Game*. Still today, many people see pinball as a predominantly luck-based game. Accordingly, the aim of the technical project is not only to show off school spirit and engineering design skills by modernizing the design, but also to thoughtfully implement a plethora of features that reward player skill to combat the assertion that pinball is a solely luck-based game. The STS project will investigate what aspects of early pinball machines led to the 1942-1976 ban in New York as well as examine the case study of Roger Sharpe's court case in 1976.

Technical Project

Looking deeper than a pinball machine's exterior, they are not as simple as they appear. The machines contain a multitude of mechanisms, switches, and electronic components all working in synchronization with one another to function effectively. However, due to its early origins, not all a pinball 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.

In 2016, a group of fourth-year mechanical engineering students began work on a UVA-themed pinball machine for their capstone project. Though the team undoubtedly made great progress including the completion of a fully functioning playfield, working flipper mechanisms, and working prototypes of many other components, the project was left unfinished. The aim of this year's capstone team is to pick up where the 2016 team left off while taking the opportunity to learn from their mistakes by managing the large team dynamics better and more rapidly prototyping parts to allow time for sufficient design iterations to perfect the components the previous team started on.

Key aspects of the pinball machine will include custom flippers, drop targets, pop bumpers, ramps, ball traps, vertical up-kickers, and ball save mechanisms. Many of these mechanisms will be powered by both off the shelf and custom solenoids and linear actuators. The machine will also include electronic sensors to monitor the ball's position as well as current levels in the circuits and temperature levels of solenoid to maintain safety. Each one of the components will be designed, prototyped, manufactured, and assembled in the Fall 2023 semester. Given the large number of group members (17) and faculty support the approximate budget for this project is \$5,000.

The design of the game will revolve around the player hitting three different drop targets, each in front of small OLED displays that, along with LED arrays, will change what they display based on which level the game is in. Levels will include first-year through fourth-year mode as well as a final alumni/faculty mode. After all three targets are hit the player will move on to the next level.

Sticking to the UVA theme, the pinball machine will include a cast iron rotating rotunda as both a centerpiece of the machine and a main obstacle in the game. Additionally, it will contain models of Scott Stadium, the Beta Bridge (which will feature LED arrays to allow the player to “paint the Beta Bridge”), and Bodos Bagels themed pop bumpers. The machine will also contain wireform ramps beneath the playfield with a trapdoor mechanism to represent UVA’s steam tunnels. Finally, the game’s scoring system will be based on credit hours.

To accomplish the goal in relation to the STS project, the game’s scoring system will reward the skill of players by giving extra points (or credit hours) for hitting drop targets, completing the different levels, and going through the steam tunnels. It will also incorporate ball save mechanisms that players can strategically aim for to keep the ball in play.

Complex in its overall design, this UVA-themed pinball machine will prove to be a fascinating and attractive physical display for the engineering department in the game room of UVA’s 1515 Student Center. This process will leave a tangible and lasting legacy while providing a unique, hands-on learning experience to the team. The technical team will gain skills in 3D modeling, 3D printing, laser cutting, CNC machining, circuit design, programming, and physical assembly, essential abilities for future engineering careers. Above all, the pinball project shall inspire current undergraduates, faculty, visitors, and prospective students on tours by demonstrating the exciting and advanced projects the mechanical engineering program offers.

STS Project

The STS portion of this thesis will focus on examining the time that pinball machines were banned in New York City, which lasted from 1942-1976. Research into what particular design features of early pinball machines led to the ban and what changes in the design occurred throughout the duration of the ban will be a primary focus. This research will assist in understanding the transition of the perception of pinball as a means of gambling towards a competitive game of skill. There will also be an analysis of the technological politics of pinball machines through the examination of the politics of the 1942 ban and a case study analysis of Roger Sharpe's 1976 city hearing that resulted in the legalization of pinball. This research and analysis will serve to answer the question: "What political factors and aspects of the design of pinball machines led to the 1942 ban and what changes in the design up to 1976 led to the lift of the ban?"

Understanding pinball's early history is crucial to understanding the reasons for the ban. Preliminary research into why pinball was banned has already been conducted. Upon its first invention during the great depression and before the invention of flippers in 1947, pinball players were at the mercy of the random bounce of the ball making it a game of sole luck. Gambling on games ran rampant in New York City, with players betting their hard-earned money and operators handing out prizes from free games and gum to jewelry. Also, most pinball machines were manufactured in Chicago which was a hub of organized crime during the great depression. (King, 1966). Much of the pinball industry was linked to organized crime at this time, effectively corrupting its image. Moreover, WWII called for a manufacturing boom which made pinball

manufacturing seen as a waste of materials. The engineering choices of early pinball machines, alongside these political factors eventually led to the 1942 ban proposed by former New York City mayor Fiorello La Guardia (Black, 2012).

Examining the design changes of pinball machines, point out the technological politics of pinball and explain what factors ultimately led up to the lift of the ban. Notable advances in pinball during the duration of the ban included the invention of flippers, the invention of the tilt mechanism (which allows the player to physically tilt the playfield to keep the ball in play, the invention of drop targets and multi-balls, and the implementation of a scoreboard behind the playfield (before this the score was on the playfield). (Bellis, 2019). The change to the scoreboard is important because it shifted the emphasis from the importance of keeping eyes on the score to the ability to focus on the game itself. This, alongside the implementation of the new features directly contributed to pinball's evolution towards a game of skill. These advances culminated with Roger Sharpe being able to prove pinball was more skill than luck by calling a difficult shot at a New York City hearing in 1976 saving the game of pinball (Klein 2016).

A direct analysis of the case studies of LaGuardia and the New York city council's decision to ban pinball in 1942 as well as Sharpe's city hearing in 1976 provides a perfect opportunity to apply the STS framework of technological politics highlighted by Langdon Winner's "Do Artifacts Have Politics?" This framework will allow for the application of the concepts of technological and social determinism to this case study on pinball's outlaw (Winner, 1980). Looking at this case study through this STS lens will serve to connect the politics of this case study to the engineering of the artifacts, which in this case is pinball machines and their components.

My timeline for this research has already begun as significant base research was undertaken to produce this prospectus. Furthering my research in the next few weeks and months will be my main priority. This research will focus on historical background on the evolution of the design of pinball machines from their first invention in the 1930s to their golden age in the early 1980s. Additionally, to find further primary and secondary sources directly related to New York's former mayor Fiorello La Guardia and the city council's decision to ban pinball in 1942 and Roger Sharpe's city hearing in 1976. This will include using resources from UVA's library database, scholarly articles from the public domain, and Bibliographies from previous literature.

Conclusion

The technical project deliverable will be a fully functioning UVA-themed pinball machine intended to form an inspiring and entertaining display in the game room of UVA's Student Center at 1515 University Avenue. The technical team will strengthen design, modeling and manufacturing skills in the creation of a cohesive final product. A final technical report shall document this process. The product will draw visitors and fellow students and demonstrate the prowess of University of Virginia engineering.

The STS paper will provide an improved understanding of the history and controversy of pinball during its ban in New York City, analyzing how design choices shifted the machines from gambling devices to competitive games of skill. This case study analysis will inspire other aspiring engineers to more deeply consider the history of technologies when developing them and to more deeply investigate why certain design choices were made.

Altogether, the added understanding of pinball's early controversy from the STS project will allow for the technical project to be designed around these controversies by developing a state-of-the-art pinball machine that emphasizes player skill more than luck.

References:

- Bilek, A. J., & Ganz, A. S. (1965). The Pinball Problem. Alternative Solutions. *The Journal of Criminal Law, Criminology, and Police Science*, 56(4), 432–445.
<https://doi.org/10.2307/1141672>
- Ruben, A. (2017). A Vicious Form of Amusement. In A. Ruben (Ed.), *Pinball Wizards: Jackpots, Drains, and the Cult of the Silver Ball* (pp. 23-42). <https://ebookcentral-proquest-com.proxy1.library.virginia.edu/lib/uva/detail.action?docID=4856352>.
- Anonymous. (1950). Slot Machines and Pinball Games. *The Annals of the American Academy of Political and Social Science*, 269, 62–70. <http://www.jstor.org/stable/1027818>
- King, R. (1964). The Rise and Decline of Coin-Machine Gambling. *The Journal of Criminal Law, Criminology, and Police Science*, 55(2), 199–207. <https://doi.org/10.2307/1140748>
- King, R. (1966). The Pinball Problem in Illinois. An Overdue Solution. *The Journal of Criminal Law, Criminology, and Police Science*, 57(1), 17–26. <https://doi.org/10.2307/1140949>
- Klein, C. (2016, November 15). *That Time America Outlawed Pinball*. History.com.
<https://www.history.com/news/that-time-america-outlawed-pinball>

Black, J. (2012). Pinball: The Misunderstood Game of Amusement. *A Journal of Academic Writing*, 21. http://danny.cdyn.com/Milestones_2011.pdf#page=22

DeLeon, C. L. (2012). *Arcade-style game design: postwar pinball and the golden age of coin-op videogames* (Doctoral dissertation, Georgia Institute of Technology).
https://chrisdeleon.com/gatech/chrisdeleon_pinball_thesis.pdf

Terry, C. (1993, August 8). *How the pinball machine got those flippers*. Chicago Tribune.
<https://www.chicagotribune.com/news/ct-xpm-1993-08-08-9308080283-story.html>

Kocurek, C. A. (2015). *Coin-Operated Americans: Rebooting Boyhood at the Video Game Arcade*. University of Minnesota Press. <http://www.jstor.org/stable/10.5749/j.ctt19704vf>

Bellis, M. (2019, September 21). *The entire history of pinball and pinball machines*. ThoughtCo.
[https://www.thoughtco.com/history-of-pinball-1992320#:~:text=Pinball%20manufacturer%20Steve%20Kordek%20\(1911,of%20the%20pinball%20playing%20field](https://www.thoughtco.com/history-of-pinball-1992320#:~:text=Pinball%20manufacturer%20Steve%20Kordek%20(1911,of%20the%20pinball%20playing%20field).

Chambers, K. (2011). The Emergence of Gambling within a Historically Contingent Framework. In K. Chambers (Ed.), *Gambling for Profit: Historical Contingency and Jagged Growth* (pp. 3-20). <https://doi.org/10.3138/9781442690080>

Winner, L. (1980). Do Artifacts Have Politics? *Daedalus*, 109(1), 121-136.

<http://www.jstor.org/stable/20024652?origin=JSTOR-pdf>