Pinball Design

(Technical Paper)

Gaming Addiction and the Responsibility of Developers

(STS Paper)

A Thesis Prospectus Submitted to the
Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements of the Degree
Bachelor of Science, School of Engineering

William McClung

Fall 2023

Technical Project 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, Jacob Leynes, Gabriel Lu, 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

Signature William McClung Date 11/21/23
Author Name

Approved _____ Date _____
Gavin Garner, Department of Mechanical Engineering

Approved _____ Date _____
STS Advisor: Richard D. Jacques, Ph.D., Department of Engineering & Society

Introduction:

With the rapid development and integration of technology into daily lives, engineers find themselves faced with the large responsibility of ensuring design safety. A specific sector in which this issue has emerging prominence is the game industry. From the advent of mechanical games like the iconic pinball machine in the early 1900s to the sophisticated video games of today, the evolution of gaming has been a remarkable journey.

The early 1900s was swept by the introduction and development of mechanical games such as the pinball machine. These games were a large hit with the general public, especially pinball. Proliferating styles of the game addicted so many people that for decades, pinball was illegal in many US cities, including New York City, Chicago, Los Angeles and Oakland (Vaughn 2011). Development then transitioned to arcade games, followed by the release of the first consoles, and finally resulted in the video games of today. Despite their technological differences, these games all share similar qualities that keep them relevant today.

To survive their illegalization movement in the mid 1900s, pinball manufacturers started focusing more on art and appeal in their games. The manufactures added more carnivalesque imagery, louder and more frequent sound effects, and innuendo in their themes (Vaughn 2011). This is a distinctive point in game development where an evident change in design considerations was apparent. These mechanical games, for all the fun they were to play, were designed to make money. Pinball designers intentionally made their games more addictive, employing in-game features designed to psychologically engage and captivate the player. The

allure of these games was undeniable, making them a form of mass entertainment long before the digital era.

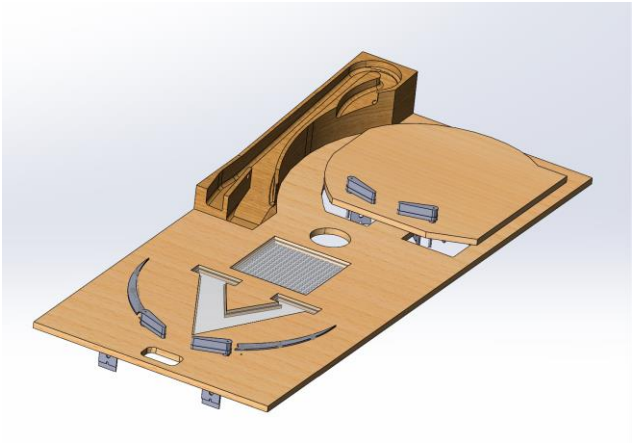
This same logic is being applied to an even larger extent in the modern games with technology making the effects of this logic all the more intense. As technology advanced, the gaming landscape transformed from mechanical amusements to arcade games and eventually, home consoles. In the technical portion of this paper, I will delve into the design of the pinball machine that my capstone team is creating. I will discuss the specific design considerations we are implementing to ensure not only the player's satisfaction but, crucially, their safety. The legacy of pinball continues to inform our design, prompting us to prioritize responsible gaming. In the research on Science, Technology, and Society (STS), I will explore the pressing issue of game addiction. This involves an examination of the ethical responsibilities of contemporary game developers in crafting experiences that entertain without causing harm.

Technical Topic:

In 2016 a capstone group under the direction of Professor Gavin Garner embarked on creating a UVA themed pinball machine. This was an ambitious project for the accelerated capstone and the group made it about a third of the way through. The current capstone class is picking up the project with the goal of installing a functioning UVA pinball machine in 15-15 (student hangout spot with arcade on the corner) for students and members of the community to enjoy. The goal is to provide students and the broader community with an enjoyable and immersive UVA-themed pinball experience.

The project started where the 2016 capstone team left off. The team had a general design and structure for the game as well as some parts already manufactured. Components like the playing field, ramps for the ball, and flipper assemblies have already been made. This provided us with the general framework of the playing field but left much of the game design up to us. With the groundwork laid, our group's initial focus has been to chart the game's path and scoring system. We have contemplated at length how to infuse UVA and Charlottesville unique themes and characteristics into the game, ensuring that it offers players a personalized and captivating experience. These design aspects are crucial in making the game resonate with its intended audience, creating a connection between the player and the virtual world we are crafting.

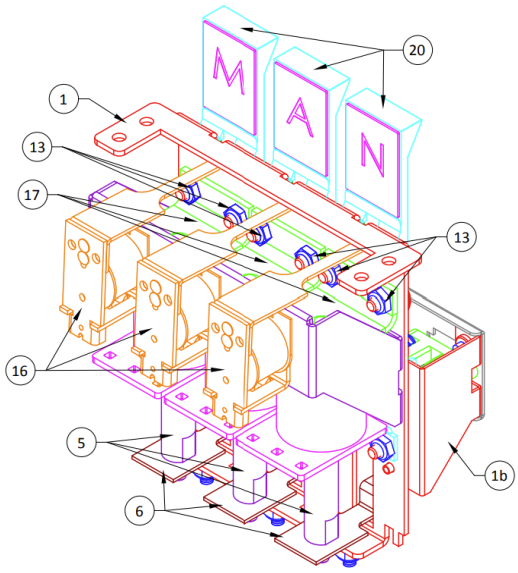
Our group began by laying out the scoring and player path for the game. We incorporated themes and traits specific to UVA and Charlottesville to create a personalized experience that would provide players with a fun and interesting game. We will demonstrate how responsible design can not only produce a captivating UVA-themed pinball machine but also address the broader ethical concerns that contemporary game developers face.



Pinball Field Layout

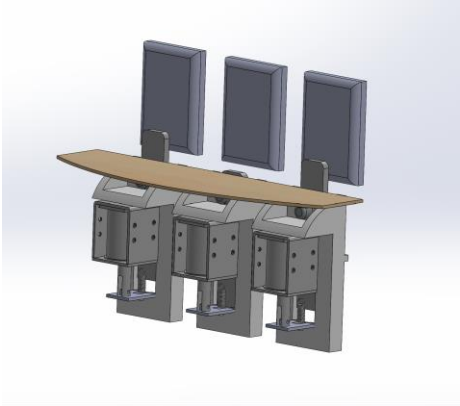
After brainstorming and planning the group moved into the next phase of the project involving mechanical design and manufacturing. This capstone group is challenged with building and implementing the mechanical features a pinball game implores such as pop bumpers, vertical up kickers, and drop targets. Drop targets are a feature of pinball machines in which the player hits the ball into the target to achieve some objective and the target will fall indicating achievement. In working with the team on the drop target design several considerations emerged involving both the mechanical actions that need to be completed as well as the player experience we hope to convey.

To begin laying out the general framework of the design I referenced the manual of Jerseys Jacks, The Hobbit, pinball machine. This provided a technical look into a production drop target design.



Drop Target Design Reference (Jersey Jacks 2018)

Our group initially considered three different methods of power for resetting the targets including a solenoid, a linear actuator, and an electromagnet.



Drop Target Design Consideration

I explored the solenoids in the drop target design but we ultimately decided on a linear actuator for its durability and functionality. The linear actuator provides us with the unique ability to raise and even lower our targets on command allowing for the niche personalized experience we hope to provide with our design.

STS Topic:

In the entertainment industry of today gaming has become one of the most popular pastimes. The Entertainment Software Association estimates that around 60% of Americans, around 145 million people in all, currently play some type of video game and though this covers all age ranges, 30% of these Americans are youth and it is within the youth that the danger lies (ESA 2018). When human brains are young and in development they are most susceptible to influence from what happens in everyday life. Certain aspects of video games that reach the youth including those that involve violence and other age inappropriate aspects are likely to be associated with poor behavioral patterns (Kutner 2008). It has been argued that videogames and slot machines have more inherent similarities than differences, (i.e.

conceptually, psychologically, behaviourally, etc.), and that videogame playing can be described as a non-financial form of gambling, playing for points instead of money (Griffiths 1991, 2005). When consumer goods that exhibit these qualities are made widely available, concerns arise regarding the intent of developers. Are these games being made with the harmless fun that we all imagine being the driving motivation or do developers intentionally add features to increase play time and player spending?

Both driving themes are apparent in current on-shelf games and while some developers certainly have the wrong intent, there are companies like Nintendo that design games with the player's health as a primary concern. With the Nintendo Wii (NW), the Nintendo company aimed at creating a video game that had both mental and physical benefits. With cognitive games that prioritize activities that involve attention, memory and movement skills and exergames which are games that include a significant amount of exercise requiring physical movement from the player, the NW has even gone as far as being used in neurocognitive rehabilitation (Pessoa 2014). The same cannot be said about several of Nintendo's competitors. Activision and Treyarch are two larger video game developers that collaborated on one of the most popular video game series, Call of Duty. This is a first person shooter game that involves lots of violence, frustrating endings, and is really fun to play - for the appropriate player. Features like game modes that never end, lengthy in-game tasks, and pay to win themes encourage unhealthy player habits such as overplaying.

The ethical considerations surrounding video game development are multifaceted. The responsibility of game developers extends to the well-being of their players, particularly the impressionable youth. While some developers may prioritize profit over player health, others like Nintendo have demonstrated that games can promote cognitive and physical health. As the

gaming industry continues to evolve, it is crucial for developers to consider the potential consequences of their creations on the mental and physical health of their audience.

Research and Analysis:

The driving question of our capstone design is how the best user experience can be created. Our group will use this question as a goal for all design decisions to create a unique finished product. With features like player decisions, balanced scoring, and multiball our pinball machine implements an appealing layout. Our thematic design is catered toward the end user. In finalizing the design our team will strive for an intuitive playing field with engaging gameplay.

Conclusion:

Games can be a fine source of entertainment when designed and applied appropriately. With our capstone project our team hopes to provide an enjoyable entertainment platform that encourages responsible gaming. The customized pinball machine will feature a unique player progression with realistic score levels. In 15-15 the machine will provide entertainment to students and faculty alike. There is much work to be done and many design decisions are yet to be made. When they arise the team will be sure to consider the end user ensuring ethically correct decisions. The end user is a fundamental consideration, one that all game developers should heed, and responsible companies in the field, such as Nintendo, exemplify the way forward with their innovative and interactive platforms.

In the gaming industry, it is essential to recognize the dual nature of its impact on consumers' lives. Video games have become a widely embraced form of entertainment, skill development, and cognitive stimulation to millions.However, there are concerns about the

potential adverse effects, particularly when it comes to the influence of violent content and the design of games that encourage unhealthy gaming habits. Developers have a large responsibility in shaping the ethical dimensions of this industry, and the case of Nintendo's Wii serves as a testament to the positive potential of gaming. As the industry continues to push the boundaries of technology, the welfare of the players, especially the younger generation, should remain at the forefront of developers' intentions. Finding a balance between providing engaging entertainment and fostering player well-being is not only ethical but also crucial for the lasting success of the gaming landscape.

References:

Bondolfi G., Ladouceur R. (2001) Pathological gambling: an increasing public health problem. *Acta Psychiatrica Scandinavica*, 104, 241–242.

Griffiths, M. (2014, October 16). Joystick Junkies: A Brief Overview of Online Gaming Addiction. Dr. Mark Griffiths' Blog. Retrieved from URL

Lamiaa Mostafa and Marwa Abd Elghany. Investigating Game Developers' GUilt Emotions Using Sentiment Analysis https://www.researchgate.net/profile/Lamiaa-Mostafa-2/publication/329596167_INVESTIGATING_GAME_DEVELOPERS%27_GUILT_EMOTIONS_USING_SENTIMENT_ANALYSIS/links/5c404723a6fdccd6b5b2f36e/INVESTIGATING-GAME-DEVELOPERS-GUILT-EMOTIONS-USING-SENTIMENT-ANALYSIS.pdf

Griffiths, M.D., Meredith, A. Videogame Addiction and its Treatment. J Contemp Psychother 39, 247–253 (2009). https://doi.org/10.1007/s10879-009-9118-4

Kutner, L., & Olson, C. K. (2008). Grand theft childhood: The surprising truth about video games and what parents can do. Simon and Schuster.

Entertainment Software Association. (2018). Essential Facts About the Computer and Video Game Industry. https://www.theesa.com/wp-content/uploads/2021/03/ESA_EssentialFacts_2018.pdf

Pessoa, L., Gutierres, P., Faísca, L., Maia, J., Barbosa, F., Ferreira, S., ... & Castro-Caldas, A. (2014). Rehabilitation using the Nintendo Wii gaming system. Portuguese Journal of Physiotherapy, 6(1), 18-24.

Jersey Jack Pinball. (2018, November). The Hobbit Operation Manual. Retrieved from https://www.manualslib.com/products/Jersey-Jack-Pinball-The-Hobbit-9251643.html