

Artificial Intelligence E-thello
Sports Gambling: Examining Sports Betting Companies, Vulnerable Populations, and
Regulatory Mechanisms

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 Computer Engineering

By
Lawrence Truong
December 1, 2023

Technical Team Members
Ziang Jiao, Brian Lai, Dennis Tian

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

Joshua Earle, Department of Engineering and Society
Adam Barnes, Department of Electrical and Computer Engineering

Introduction

The technical project that my team members and I are pursuing is the creation of an electric Othello board, fitted with an artificial intelligence program that will simultaneously act as an opponent and suggest possible moves for the user. The STS portion of this project will culminate in a research paper arguing the negative impacts online gambling has on adults and suggestions for regulations pertaining to online sports bettings. The focus of my research will center around the question, How can current online sports gambling guidelines and regulations be improved to limit or curb gambling addiction? Recently, there has been a massive push towards online gambling through several media outlets. There are many advertisements in social media, television, etc, promoting gambling (Adgate). These advertisements entice users by offering free money for first time bets and introduce people to the world of online gambling. In writing this prospectus, I will follow a traditional approach to research. Defining a strong research question is crucial because it allows for a clear research paper and having multiple strong resources allows for a thorough analysis and conclusion. Identifying and defining relevant social groups will provide diverse perspectives and cultural insights. Lastly, a suitable research method and framework must be established to formulate an argument with backed evidence.

Technical Project

The E-thello board is an electronic Othello board that allows users to play against a built-in artificial intelligence program with multiple difficulty levels. What makes this stand out from ordinary computer Othello is that it is played on a physical board that features move highlighting, automatic board updating, and more, making it great for beginners wanting to learn the mechanics of the game or for players that want the benefits of online Othello on a physical

board. This project will involve a sophisticated program that will have two purposes: to play as the opponent and to determine the user's valid moves. The software will be integrated with the main PCB, which will consist of 8 LED Strips arranged to form an 8x8 grid of LEDs, along with buttons accompanying each LED. The LEDs will be controlled through the Raspberry Pi, which will use pre-existing Neopixel libraries that simplify interfacing with the LEDs. In addition, the buttons will be wired in an 8x8 array to determine which square the user chose; they will also be controlled through the Raspberry Pi 4. Lastly, all of these components will be assembled and housed in a 3D-printed enclosure.

The E-thello board will consist of five main components, the printed circuit board, the artificial intelligence-based algorithm program, the LED control algorithm, the power system, and the mechanical design of the Othello board. The printed circuit board will house the sixty-four push buttons for each tile of the Othello board, accompanied by sixty-four Schottkey diodes to limit any unwanted current flow in the circuit. The array will be controlled by eight row and eight column pins. When a button is pressed, the circuit will be completed allowing the current to pass through a row and column, indicating which button was pressed. The AI algorithm that we will be using is the Minimax algorithm, with a few optimizations. The Minimax algorithm essentially minimizes the maximum possible loss that a player can face. The optimizations that we will use are the alpha-beta pruning and MTD(f) algorithm, which at a top level will speed up the time it takes to calculate a move. The LED control algorithm will be a program that determines all possible moves that can be taken by the player, flip all captured pieces made by the player or computer, and play the computer's moves. The power system will be a power bank that will supply power to the Raspberry Pi, LED strips, and the printed circuit board. The mechanical design of the Othello board consists of the housing and buttons. The

housing is split into two structures, the outer shell and the inner shelf. The outer shell is a hollow cubic container with an eight by eight unchecked board pattern. Each square will have a circular cutout for the Othello pieces. The inner shelf is a two-layered shelf that will hold the PCB on the top layer and power bank and microcontroller on the bottom layer. The outer shell will be fitted on top of the inner shelf to form the Othello board. Sixty-four Othello pieces will be fitted into the circular cutouts in the outer shell. The LED strips will be threaded through the pieces.

The Overall control flow of the Othello board starts with the power bank supplying power to the Pi, LED strips, and the printed circuit board. Then the AI and LED control algorithm is loaded into the Pi. Once the Othello game begins, the player will press a tile indicating their move. When the player presses an Othello piece, an instruction will be sent back to the Pi to update the game state. The Pi will update the game board via the control LED algorithm. Then the AI algorithm will play the computer's turn and update the LEDs. These processes will cycle until the algorithm detects an end state, when the computer or player wins the game.

STS Project

Research Question

The technology that I will investigate is electronic gambling. I wanted to explore this topic because this technology was recently legalized in many states throughout the country. It has been heavily broadcasted and advertised in every type of media outlet, from social media, to influencers, and even television. Gambling is not a new concept, it spans back since even before history was recorded. Gambling is a potent and highly addictive activity that is heavily regulated. There are many rules and regulations that casinos must follow in order to operate. This makes

gambling relatively hard to engage in because of the inconveniences one must go to gamble. However, online gambling, combines the excitement and thrill of gambling with the relative ease of access to the internet. Pairing that with TV advertisements, celebrity gambling promotions, and the thrill of easy money, can have a negative influence on adults. So my research question for this topic is: How can current online sports gambling guidelines and regulations be improved to limit or curb gambling addiction? This is an important topic to discuss because in 2018, online gambling was legalized in many states throughout the country (Preciado). This allowed for easier access to gambling because the internet is widely used throughout the country. Additionally online gambling is more convenient because it can be done through smartphone apps. With online gambling people are able to gamble with a push of a few buttons, instead of having to travel to an authorized location. The widespread use and advertisement of this technology has serious consequences on young adults and even children because “those with greater exposure to sports-betting advertising in digital media [are] more likely to bet regularly on sport” (Browne, Hing, Russell, Thomas, & Jenkinson (n.d.)). These kinds of narratives can create new gambling addictions or fuel current ones.

Relevant Social Groups

A relevant social group for online gambling are young adults because they are adept at surfing the internet. Additionally, young adults make up a large demographic of social media users. On social media, there are influencers and celebrities that promote gambling by shouting out the gambling website or posting large winnings from bets. Additionally, online sports bettings can prey on naive adults by enticing them with free money for their first bets (DataArt). This presents a massive risk to young adults because these predatory advertisements present the idea that people can make easy money by betting small amounts. Overall, this is an important

social group because the current regulations leave young adults vulnerable to exploitative companies.

Sports gambling companies play a massive role in online gambling. Companies like FanDuel, DraftKings, Caesars, BetMGM, etc. pump millions of dollars into advertisements to push their brand across the nation and to attract new customers to their business (iGB). This behavior poses a significant threat to people of all ages because these ads introduce gambling to its viewers. People exposed to online gambling ads exhibit a higher probability of regular betting. (Browne, Hing, Russell, Thomas, & Jenkinson (n.d.)). This is also an important social group to focus on because this group is the one partially responsible to gambling problems.

Another relevant audience are the people who are participants of the game that is being gambled on. While this is a niche audience, there have been many examples of coaches, players, relatives of players, etc. that have betted on a game they are a part of. “In November 2019, Arizona Cardinals cornerback Josh Shaw was suspended for gambling on an NFL game; he has not played in the league since” (AP News). This is a massive problem because active participants can manipulate the outcome of a game and therefore, determine the results of bets. Additionally this is highly illegal because active participants can pass on insider information to Sportsbooks to adjust the live odds, as well as rig the games themselves. While this is a relevant social group, this will not be the focus on this paper.

Method & Framework

I will collect evidence through historical and philosophical methods by finding, reading, and synthesizing previous literature. This method will allow me to conduct background research on Technological Momentum and studies conducted around online gambling. Additionally, the

use of public policy will provide relevant information on the online gambling rules and regulations.

The framework that I will be adopting is the Theory of Technological Momentum (Hughes, 1969). This theory describes technology as a novel innovation that undergoes development and refinement in its early stages. As the technology advances, people are more invested into the product furthering its growth. Once the technology becomes widespread it intertwines itself into society. People are reliant on this technology for day-to-day life and this makes it difficult to introduce any changes to the technology; they become more difficult to control and regulate. At this point, attempts to change or regulate the technology will face harsh criticism and scrutiny by people who have a vested interest in the technology. This theory is applicable to online gambling because it is still a new technology. Due to this, it is still possible to to change and regulate guidelines for virtual reality games to ensure that ethical and responsible standards are met.

Timeline

The timeline can be simplified into four steps. The first step is to do some preliminary background research into the virtual reality gaming industry. Then searching for evidence through the STS databases and internet. Next analyzing the information through the lens of the Theory of Technological Momentum. Finally formulating an argument and conclusion.

Key Text

This article is an analysis of a case study, mentioned below. It explores the two types of gambling: fixed-odds and live odds. Fixed-odds gambling are bets made on the outcome of a game, whereas live odds are bets made on propositions about outcomes within a sporting event (e.g. number of goals a player scores, number of touchdowns, yardage, etc.). They use this

information to study the behaviors of those who are and are not heavily involved in gambling. This is an important source to include because it dives into the behaviors of excessive gamblers. There is also discourse on the results of the study which could prove useful when framing my own arguments and conclusions (LaBrie, LaPlante, Nelson, Schumann, & Shaffer).

This article details the rules of online sports betting in Virginia. This will be important in laying the background for rules and regulations in place for online sports gambling. Additionally when proposing new rules, changes, and updates, it will be a good resource to reference to make sure that there is not already an existing similar rule (Code of Virginia Code).

This article discusses efforts to reduce the harmful effects of gambling by limiting the deposits that a user can make. This study was conducted by an online sports betting service that limited a user to €1000 a day or €5000 in a span of over 30 days. There are also ways to exceed the deposit limits. One way was to have a flexible limit, which would automatically increase based on the user's winnings. The other way to provide evidence of exceptional financial means. This article will be important in my research because the study explores the behavior of those who do go over the limit and those who do not. Using this information, I can formulate ways to improve online sports betting rules and ensure ethical and responsible technological development (Broda, LaPlante, Nelson, LaBrie, Bosworth, & Shaffer).

This article conducts a study on 789 sports fans across 47 states. These fans were split into distinct groups: bettors and non-bettors. The purpose of the study was to explore differences in demographic, self-concept and fan behavior factors that predict sports fans who bet and those who do not in legal and illegal gambling jurisdictions in the United States. This article is important because it will assist in helping me determine the positive and negative consequences

of sports betting. I can also see which age demographics are most affected and the results of the studies will help me form an argument for online sports betting (Dwyer, Hayduk, & Drayer).

References

- 4 Most Powerful Strategies for Acquiring Customers to Your Sportsbook.* (n.d.). Retrieved October 25, 2023, from <https://www.dataart.com/blog/4-effective-customer-acquisition-tactics-for-your-sports-betting-business>
- Adgate, B. (n.d.). *Sports Betting Is Revving Up Ad Spending For Fourth Quarter.* Forbes. Retrieved October 25, 2023, from <https://www.forbes.com/sites/bradadgate/2022/09/15/sports-betting-is-revving-up-ad-spending-for-fourth-quarter/>
- As NFL cracks down on players gambling, what events are pro athletes allowed to bet on?* (2023, June 29). AP News. <https://apnews.com/article/nfl-gambling-suspensions-nba-mlb-nhl-a46958a64d87086a0c37118bd457f72f>
- Broda, A., LaPlante, D. A., Nelson, S. E., LaBrie, R. A., Bosworth, L. B., & Shaffer, H. J. (2008). Virtual harm reduction efforts for Internet gambling: Effects of deposit limits on actual Internet sports gambling behavior. *Harm Reduction Journal*, 5(1), 27. <https://doi.org/10.1186/1477-7517-5-27>
- Browne, M., Hing, N., Russell, A. M. T., Thomas, A., & Jenkinson, R. (n.d.). The impact of exposure to wagering advertisements and inducements on intended and actual betting expenditure: An ecological momentary assessment study. *Journal of Behavioral Addictions*, 8(1), 146–156. <https://doi.org/10.1556/2006.8.2019.10>

Code of Virginia Code—Article 2. Sports Betting. (n.d.). Retrieved October 11, 2023, from

<https://law.lis.virginia.gov/vacodefull/title58.1/chapter40/article2/>

Dwyer, B., Hayduk, T., & Drayer, J. (2021). A comparative analysis of sports gambling in the United States. *International Journal of Sports Marketing and Sponsorship*, 23(4), 684–706. <https://doi.org/10.1108/IJSMS-03-2021-0074>

LaBrie, R. A., LaPlante, D. A., Nelson, S. E., Schumann, A., & Shaffer, H. J. (2007). Assessing the Playing Field: A Prospective Longitudinal Study of Internet Sports Gambling Behavior. *Journal of Gambling Studies*, 23(3), 347–362.

<https://doi.org/10.1007/s10899-007-9067-3>

Preciado, D. (2023, February 28). *States Where Sports Betting Is Legal*. Forbes Betting.

<https://www.forbes.com/betting/guide/legal-states/>

Team, iGB E. (2023, January 6). How much do sportsbooks spend on marketing and will it lead them to profit? *iGB*.

<https://igamingbusiness.com/marketing-affiliates/how-much-do-sportsbooks-spend-on-marketing-and-will-it-lead-them-to-profit/>