People have always had some mistrust of machines. Part of that mistrust may stem from a fear of being replaced by a computer or a fear of a computer malfunction that causes a disaster. With technology constantly improving and affecting more and more of our daily lives the fear of a disaster caused by a computer becomes more real with the passing of time. One particular place that has seen some of the most radical changes due to the integration of technology is securities trading. Advances in technology and new Securities and Exchange Commission (“SEC”) rules, which give traders more access to the exchanges, has given rise to high-frequency trading (“HFT”).

HFT is a trading strategy that utilizes super computers to trade securities at high speeds and high-frequency traders use computer programs to quickly scan the market to locate and exploit pricing discrepancies. The rise of HFT has lead to the issue of market trades being front run by the HFT computer programs meaning that the HFT systems will anticipate an investor’s trade, initiate its own transaction, and make a profit by making the trade more expensive or less

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1 2001: A SPACE ODYSSEY (MGM 1968) (quoting HAL 9000’s, the malfunctioning artificial intelligence of the Discovery One spacecraft, last words).
3 See High-Frequency Trading – HFT, Investopedia.com, archived at http://www.webcitation.org/6BGMTLA9V.
profitable to the investor. Traders looking for an escape from the HFT “predation” have found shelter in dark pools.\(^4\) Dark pools are segments of the market offering traders anonymity, which they use to avoid HFT front running.\(^5\) Despite the advantages to traders, dark pools have been criticized for their lack of transparency, for creating a two-tiered market favoring larger investors, and for taking liquidity\(^6\) from other exchanges.\(^7\)

In Dark Pools: High-Speed Traders, A.I. Bandits, and the Threat to the Global Financial System, author Scott Patterson does not entirely focus on what is traditionally known as a dark pool on Wall Street. Instead, Patterson argues that the United States stock market has become one large dark pool. To support this proposition, Patterson points to the fact that orders are hidden from the public, not much is known about the complex algorithm and artificial intelligence-based trading systems that provide liquidity for the market, and that the United States’ regulators have little hope of doing their job because they too are being kept in the dark.

Patterson’s book is broken up into four parts: Part I: Machine v. Machine, Part II: Birth of the machine, Part III: Triumph of the Machine, and Part IV: Future of the Machine. Part I: Machine v. Machine begins with Haim Bodek, head of the HFT firm Trading Machines, dealing with what appeared to be a malfunctioning machine that was causing his firm to lose money. Bodek had no idea that solving the problem with his machine would lead to the discovery of one

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4 See Scott Patterson, Dark Pools: High-Speed Traders, A.I. Bandits, and the Threat to the Global Financial System 44 (2012) (discussing how dark pools were originally designed for large investors as a haven from high-frequency trader’s computer programs).

5 See SEC Proposes Regulation of Dark Pools, MORRISON & FOERESTER LLP, NOV. 16, 2009, at 1-2, archived at http://www.webcitation.org/6BGUY1SFd (defining dark pools as proprietary markets created for the purpose of allowing traders to trade large blocks of securities with minimal market impact, to minimize information leaks, and maintain a stable share price by providing anonymity for traders).

6 Liquidity is the degree to which an asset or security can be bought or sold without affecting its price. Definition of ‘liquidity’, INVESTOPEDIA, archived at http://www.webcitation.org/6BapmWAV5.

7 See Joan Ng, Corporate: Liquidnet Enjoying Growth in Asia as money migrates out of Europe and U.S., Edge Sing, Sept. 17, 2012 (discussing some of the criticisms that dark pools have faced such as benefitting larger players at the expense of smaller players and a lack of transparency); David S. Hilzenrath, SEC Says ‘Dark Pool’ Operator Traded Ahead Of Its Customers, WASH. POST, Oct. 25, 2011, at A11 (stating that dark pools have become major players and have begun to siphon business away from traditional markets).
of the biggest controversies of the modern day stock market. Patterson tells Bodek’s story starting from his teen years, his rise to partner in the HFT firm Trading Machines, and his attempts to solve the apparent computer problem, which was bankrupting his firm. A chapter in this section is dedicated to a brief discussion about the rise of what Patterson refers to as the “Algo Wars”, in which high-frequency traders would try to one-up each other with their computer programs, and how it led to the proliferation of dark pools. Part I finally concludes with Bodek realizing the cause of his machine issues after cornering an exchange representative at a bar. The answer causes Bodek to question his faith in the market because he realizes that there are rules in place that favor HFT firms and insiders at the expense of the investing public.

Part II: Birth of the Machine introduces the reader to Joshua Levine, a high-school dropout and a computer whiz with the goal of changing the world through the use of computers. Levine foresaw a market in which all information streamed effortlessly through microprocessors, which would match buyers and sellers and would cut out the entrenched middlemen of Wall Street. Patterson utilizes this section to explain the technological innovations that took place leading to the rise of HFT and points to the irony of the fact that Levine created his trading systems to push out the Wall Street middlemen, market makers, but in effect helped create a new class of middlemen, high-frequency traders. Furthermore, Patterson introduces the idea that companies interested in protecting themselves against the high-frequency

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8 See Patterson, supra note 4, at 13 (discussing how dark pools were originally designed for large investors as means to escape HFT systems).
9 See Patterson, supra note 4, at 23-38 (tracing Bodek’s life up to his time at Trading Machines).
10 See Patterson, supra note 4, at 44-45 (discussing how dark pools grew in popularity because high-frequency traders’ programs were constantly improving and investors needed a place to hide).
11 See Patterson, supra note 4, at 47-49 (discussing how Bodek finally found that answers he was looking for after speaking with an exchange representative).
12 See Patterson, supra note 4, at 53-58 (discussing how Bodek was deeply troubled by what the exchange representative told him about his computer problems and its implications for the market).
13 See Patterson, supra note 4, at 67 (discussing Josh Levine’s early life and his goals).
14 See Patterson, supra note 4, at 70-76 (discussing how market makers were the middlemen on Wall Street and how Levine wanted to change that).
trader’s algorithms ("algos") would create their own algos or hide in dark pools thus creating more high-frequency traders and a growth in the number of dark pools in the market.\(^{15}\)

Part III: Triumph of the Machine focuses on the mergers and the changes in the trading rules that allowed HFT to become a dominant part of the securities market. Patterson talked about how the New York Stock Exchange and Nasdaq merged with electronic trading firms and rocked the financial world by showing that most trading going forward would take place electronically.\(^{16}\) Patterson also emphasized how Regulation National Market System ("Reg NMS") lead to major changes to the market structure by mandating that an order to buy and sell a stock had to go to the venue with the best price, which allowed firms to trade through human-controlled manual markets, and by proclaiming that speed was more important than price.\(^{17}\) Patterson argued that this was a deathblow to traditional trading markets, where price and human trading was king, and forced them to adapt to electronic trading or perish.\(^{18}\)

Patterson concludes part III by talking about some of the events that revealed to the investing public that HFT could cause potential problems in the market and needed to be monitored closely. Responding to troublesome HFT events, Mary Schapiro, the chairman of the SEC, commissioned a study of HFT in 2010 which revealed charges that the market had become a servant to high-frequency traders and charged that Nasdaq was selling information to high frequency traders whose computers could quickly process the data and use it to front run trades.\(^{19}\) Many feared that HFT would cause a market destabilizing event

\(^{15}\) See Patterson, supra note 4, at 181 (discussing how high-frequency traders would either cause other firms to fight back with their own programs or seek shelter in dark pools).

\(^{16}\) See Patterson, supra note 4, at 233-37 (discussing the New York Stock exchange’s merger with Archipelago and Nasdaq’s merger with Instinet).

\(^{17}\) See Patterson, supra note 4, at 238-39 (discussing the changes that Reg NMS brought to the financial markets).

\(^{18}\) See Patterson, supra note 4, at 239 (discussing how the exchanges had to abandon the old way of doing business and had to adapt to electronic trading).

\(^{19}\) See Patterson, supra note 4, at 256-58 (discussing how SEC chairman Schapiro’s study revealed some troubling information about HFT).
and the market got a glimpse of this on May 6, 2010 when a computer glitch on an HFT computer caused the market to crash in the blink of an eye.\textsuperscript{20} The crash was made worse by the fact that one trillion dollars in assets vanished from the markets.\textsuperscript{21} Although high-frequency traders are required to always stay in the market, they found a loophole that allowed them to stay in the market without actually trading.\textsuperscript{22} As a result of the crash, market wide circuit breakers, which would trigger a brief stop in trading if a market maker made a major move in a brief period of time, were implemented.\textsuperscript{23} Despite the implementation of the circuit breakers, the market crash caused investors to lose faith in the market.\textsuperscript{24}

In Part IV: Future of the Machine Patterson talks about the current state of HFT and the direction in which it is heading. Patterson focuses on the idea that the market appears to be a rigged game working in the favor of HFT. He supported this contention by pointing to the fact that the exchanges began leasing space to HFT companies on the exchanges’ property because locating their servers, as close to the exchange floors gives HFT firms a speed boost.\textsuperscript{25} Although HFT spreads have gotten increasingly smaller, Patterson argues that the lost nickels and dimes add up over time and impact the investing public’s 401(k)’s and other investing accounts.\textsuperscript{26}

Despite having all of these advantages over most investors, the Financial Industry Regulation

\textsuperscript{20} See Patterson, \textit{supra} note 4, at 260 (discussing the market crash on May 6, 2010, which was caused by an HFT computer systems glitch).
\textsuperscript{21} See Patterson, \textit{supra} note 4, at 266 (discussing how May 6, 2010 market crash was made worse by the fact that liquidity disappeared and as a result traders could not trade their way out of it).
\textsuperscript{22} See Patterson, \textit{supra} note 4, at 266 (discussing how one of the reasons that liquidity disappeared was because high-frequency traders used a loophole to stay in the market without trading).
\textsuperscript{23} See Patterson, \textit{supra} note 4, at 274 (discussing some of the safety precautions the SEC took in response to the May 6, 2010 market crash).
\textsuperscript{24} See Patterson, \textit{supra} note 4, at 276 (stating that despite the safety measures implemented to prevent another market crash investors did not feel safe investing in the market and some even pulled their money out of their investment accounts).
\textsuperscript{25} See Patterson, \textit{supra} note 4, at 281 (showing that one of the many ways that the exchanges were catering to the HFT firms was allowing the firms put their trading servers on the exchanges’ property to get faster trading speeds).
\textsuperscript{26} See Patterson, \textit{supra} note 4, at 284 (discussing how the pennies the high-frequency traders skim do not seem like much but they add up and impact the investing public).
Authority has fined some HFT firms for misconduct such as processing fake trades into the markets at high speeds to trick other traders.  

Patterson notes that HFT has turned into a speed race with HFT firms spending hundreds of millions of dollars on techniques such as placing “shark proof” fiber optic cables in the bottom of the ocean floor and transmitting trades using microwave technology just to have a thousand of a second advantage over their competitors. In hopes of keeping up with high-frequency traders, the SEC plans to build a machine of its own called the Consolidated Audit trail (Cat), but Patterson questions why the SEC took so long to implement such a system. The future goal of HFT firms is to build computer systems that can beat humans in actual trading by making investing decisions based on company fundamentals. The programmers of the high-speed algos are also evolving because they now focus on programming “genetic” algos that kill off the weak and keep the best trading algos.

Finally, Patterson claims that HFT firms have become so powerful that it has become nearly impossible to trade without an expectation to lose some of the time. Only the biggest, most sophisticated, well-connected firms can hope to compete in the cutthroat world of HFT. Patterson ends with the idea that it seems like only a matter of time before humans stop playing an active role in trading and yield to computers.

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27 See Patterson, supra note 4, at 286 (discussing how some HFT firms use manipulative techniques such as “spoofing”).
28 See Patterson, supra note 4, at 286-89 (discussing how HFT firms are sparing no expense to shave off a thousand of a second off of their trading speeds).
29 See Patterson, supra note 4, at 291 (discussing how the SEC’s Consolidated Audit trail is a good idea that should have been implements long ago).
30 See Patterson, supra note 4, at 291 (discussing how HFT firms want to create a computer system that trades like a Warren Buffet).
31 See Patterson, supra note 4, at 309 (discussing how the new breed of algos evolve into better algos).
32 See Patterson, supra note 4, at 313 (noting that high-frequency traders have to go to work with the expectation that they will occasionally be “dinged”).
33 See Patterson, supra note 4, at 314 (discussing how HFT is turning into a game where only the well connected can hope to be successful).
34 See Patterson, supra note 4, at 335 (predicting that we are headed to a time where humans play no role in trading).
Overall, I recommend this book. It is written clearly and the story is put together well to make for a compelling read. Patterson effectively supported his contention that the United States securities market has become one large dark pool with many examples of a system favoring HFT firms, which have become the new entrenched middlemen of Wall Street. This book is great for those completely new to the securities market because it talks about the issues associated with HFT trading, tells the story of the rise of HFT, explains the regulatory rules facilitating HFT in a clear and easy to digest manner, and it discusses the future direction of HFT. This book is also excellent for people familiar with the securities market because it contains many facts, statistics, and ideas for further study allowing someone experienced in the markets the ability to get quickly up to speed with the world of HFT.

My biggest complaint of the book is the fact that the title is a bit misleading. The title of the book does not entirely refer to traditional “dark pools” but rather Patterson’s argument that the United States stock market has become a large dark pool. I found that the book did not present as much material on traditional dark pools as I was expecting given its title. Instead the book focuses more on HFT. Furthermore, Patterson took an objective approach to presenting the information on HFT and the issues associated with it. It would have been interesting to see what Patterson’s thoughts were on how the market should react in order to minimize the possibility of a massive market crash and his thoughts as to what actions regulatory authorities should take to keep up and ensure that investors are not disadvantaged by HFT firms and dark pools.